PLASTICS TECHNOLOGY

JANUARY 1960

THE MAGAZINE OF APPLIED ENGINEERING

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P&E

Achievement Award Winners

- Bopp-Decker Plastics for Sequential Impact Molding
- Titeflex for Springfield 400 flexible hose

News of the year for Epon® resin users!

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- **15 mils thick—one coat**
- **Conventional spray equipment**

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*Burgess Vibrocrafters, Inc., Grayslake, Illinois

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PLASTICS

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

January 1960, V. 6, No. 1

feature articles:

the outlook for 1960 ..... p. 33

In a series of specially written statements by ten industrial leaders, the plastics industry views and predicts its prospects for 1960.

automatic plunger molding ..... p. 40

by J. A. KEMPF

A step-by-step description and explanation of the equipment and methods utilized in a thermoset materials molding plant to automate its operations and make its moldings economical in all respects. Special attention is given to mold costs, mold design, press operation, preheater design, unloader mechanism, and related accessory equipment.

how Teflon improves surgeons' heart-lung machine ..... p. 45

by A. W. BYXBEE

How tough Teflon polytetrafluoroethylene plastic is used to improve the operation of medicine's mechanical marvel, the heart-lung machine. The properties and quality of the resin make it ideally suited to its use in this application which employs more than 40 separate plastic parts. A detailed description of the machine units and their use in critical heart surgery is given.

guest editorial:

i'm a yankee doodle dandy ..... p. 43

by L. G. MOSER

special:

WINNERS SELECTED IN 1958-1959 ACHIEVEMENT AWARDS COMPETITION ..... p. 49

engineering forums:

reinforced plastics ..... p. 54

by HARRY T. DOUGLAS

Underseas explorations—another untapped potential for reinforced plastic materials.

compression & transfer molding ..... p. 55

by PAUL E. FINA

Automate to stay alive.

moldmaking & tooling ..... p. 56

by MAX WOHLLEBEN

Latest developments in the construction of an injection mold.

exploring fabrication techniques:

pipe and tubing ..... p. 52

by L. J. ZUKOR

feature departments

4 Letters to the Editors

5 Previews of Next Month

22 What's New in Processing

19 Editorial

12 This Month In Brief

58 News of Industry

60 Names in the News

62 New Materials

65 New Equipment

68 Plastics Applications

73 New Literature

75 Book Reviews

76 Patent Digest

77 Article Abstracts

78 Calendar of Coming Events

78 Current Market Prices

79 Production & Sales

Opinions expressed by contributors do not necessarily reflect those of our editors

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"Our daily production doubled after changing to fast-curing

RCI POLYLITE

POLYESTER RESINS"

says H. D. Willcutts, prominent trailer manufacturer

That's the remarkable — and profitable — record of one company that switched to RCI POLYLITE! The H. D. Willcutts Company, Nashville, Tenn., gives full credit to the rapid curing characteristics of POLYLITE polyester resins for a 100% increase in production. The company produces trailers for Nationwide Trailer Rental System, Inc.

Panels of these vehicles also benefit via other important properties provided by POLYLITE polyester resins:

rugged strength • light weight to permit heavier payloads • outstanding resistance to corrosion • the ability to hold bolts firmly.

As a bonus, the company reports that with POLYLITE "we can now trim these panels during cure with a common linoleum knife. Previously we had to trim after cure using rotary saws with costly carbide tips."

Have *you* thought about switching to POLYLITE? Your Reichhold representative will be glad to acquaint you with the complete RCI polyester line.

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Letters to the Editors

Interviewing Job Candidates

Dear Sir:

As a constant reader of your publication, I found especial interest in the article, "Are Psychological Tests Really Necessary in our Industry?" *(Harry Douglas' Engineering Forum in the November 1959 issue, pg. 48)*

All of us here were well pleased also with his reference to the article, "How to Size Up a Man in Sixteen Minutes", by our President, Lon D. Barton. We have a small number of reprints of this article, and would be glad to furnish them, if desired.

C. D. Easly
Cadillac Associates, Inc.
Chicago, Ill.

• • •

Maximum Use Temperatures

Dear Sir:

Have you any knowledge of any article that has ever been published illustrating the most severe high temperature applications to which the various conventional plastics have successfully been subjected?

Such an article would be of value to many designing engineers who are at present laboring with applications where the operating temperatures are marginal. These people would be given great confidence to proceed if they had knowledge of other applications with similar temperature performance that had been successfully overcome.

D. J. Sloane, V-P
Lester-Phoenix, Inc.
Cleveland, Ohio

(In his reply, Lee Zukor, our Engineering Editor, noted that many articles of the type in question have been published in both PLASTICS TECHNOLOGY *and other magazines. He listed the following approximate maximum use temperatures for some plastics as being: polystyrene, 150° F.; low-density polyethylene, 150° F.; high density polyethylene, 250° F.; PVC, 200° F.; Saran, 200° F.; silicone, 500° F.; Teflon, 450° F.; cold molded, 700° F.; and Mycalex, 1,000° F. It was noted that other plastics materials are currently being experimented with that support temperatures in the range of 1,600-2,000° F.—Editor)*

Flexible Urethane Foam Sheets

Dear Sir:

Would you please advise us the name of one or more manufacturers of flexible urethane foam in sheet form? We wish to use this material as a rug underlay.

H. A. Miller
The Miltron Corp.
Greenback, Tenn.

(In his reply, Lee Zukor, our Engineering Editor, suggested Curtis Wright Corp.; Nopco Chemical Co.; Paramount Foams; E. R. Carpenter; and W. T. Burnett.—Editor)

• • •

Manufacturers of Polyester Resins

Dear Sir:

Would you be kind enough to advise me where I can obtain the names of all manufacturers of polyester resins?

H. M. Royal, Pres.
H. M. Royal, Inc.
Trenton, N. J.

(A list of 35 manufacturers, both domestic and foreign, was provided.—Editor)

Information Wanted

Dear Sir:

We are looking for a plastic scoop for our creamery trade, the scoop to hold 4-5 pounds of salt.

M. W. Cousineau
Northwestern Supply Co.
St. Cloud, Minn.

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

PREVIEWS

of Next Month

The February issue will feature the following articles:

Significant Flow Properties of Thermoplastics. L. B. Ryder, Sr. Research Engineer, Summit Research Laboratories, Celanese Plastics Co., Summit, N. J.

The extrusion and molding behaviors of thermoplastics can be understood and predicted by analyzing certain significant flow properties. Data are presented for these relationships for three thermoplastic resins, together with the equipment used in this work. The new method discussed overcomes the limitations inherent in present techniques which determine polymer fluidities at temperatures and stresses in ranges far removed from those met in actual processing operations.

•

Fabricated (Built-Up) Molds. Carl Zehr, Pres., Carl Zehr Co., Ashtabula, O.

Low-bulk, low-pressure glass/polyester molding materials offer new possibilities in product design and mold construction. Advantages of fabricated molds are given in comparison with costs for conventional high-pressure molds. Examples of three current applications for the new mold construction technique are described in detail.

•

SPECIAL SECTION

What a Plastics Engineer Should Look For When Planning to Buy Auxiliary Equipment for Compression and/or Transfer Molding Machines. E. W. Vaill, Tech. Service Engr., Union Carbide Plastics Co., Bound Brook, N. J.

PT's Comparative Data on 1960 Compression and/or Transfer Molding Machines.

PT's Classified List of Auxiliary Equipment for Compression and/or Transfer Molding of Plastics.

What a Plastics Engineer Should Look For When Planning to Buy a Thermoforming Machine. W. M. Ronayne, Sales Develop. Engr., Celanese Plastics Co., Newark, New Jersey.

PT's Comparative Data on 1960 Thermoforming Machines.

•

The Guest Editorial will be "Look Around You—Polyurethane," by J. L. Marzak, Mgr. of Market Research, National Aniline Div., Allied Chemical Corp., New York, N. Y.

•

IF PHENOLICS CAN DO IT, PLENCO CAN PROVIDE IT
AND DOES—FOR SIMPSON ELECTRIC

for over 500
Simpson-molded parts
Simpson
specified
molding materials
by
PLENCO

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

You don't have to baby the VOMs, VTVMs and other widely-used electrical measuring instruments made by Simpson Electric Company, Chicago. They're built for toughest service, accuracy and sensitivity. Housings, covers, knobs and handles, too, must be *right*—molded of materials that are dimensionally stable, high in electrical, impact and heat resistance, and with preformability characteristics that permit the close tolerances specified at any given check point. We regard it as a commendation that, in over 500 separate instances, Simpson engineers turned to Plenco for these approved phenolic molding materials.

Like Simpson, an ever-increasing number of manufacturers, designers and molders have learned to rely on Plenco phenolic compounds (ready made *or* specially made) to help solve today's challenging product and production problems. We'd like to show you how Plenco does it—and how Plenco can do it for *you*.

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin
Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

ARGUS MAKES VINYLS BEHAVE!

Can you control the behavior of vinyls? Argus says "yes."

Continuous, creative research—on vinyl reactions to heat, light, sulphide staining, outdoor weatherability and scores of other tests—gives Argus an intimate knowledge of the behavior of vinyl products *under conditions of actual use*. Thus, we can make your vinyls behave—in processing and in performance—by providing you with Mark stabilizers or Drapex plasticizers to meet your needs.

If, for example, your basic requirement is exceptional heat and light stability, you'll get it consistently, and at less cost, with Argus Mark LL—the most effective vinyl stabilizer on the market today. And for any *special* problems, *Argus gets the answers.*

Why gamble on the quality of your products or on customer satisfaction? Call or write for consultation, technical bulletins, samples.

ARGUS CHEMICAL CORPORATION / New York and Cleveland

Main Office: 633 Court Street, Brooklyn 31, N.Y. Branch: Frederick Building, Cleveland 15, Ohio

Rep's.: H. M. Royal, Inc., 11911 Woodruff Ave., Downey, California; Philipp Bros. Chemicals, Inc., 10 High St., Boston; H. L. Blachford, Ltd., 977 Aqueduct St., Montreal. European Affiliates: SA Argus Chemical NV; 33, Rue d'Anderlecht, Drogenbos, Belgium—Lankro Chemicals, Ltd.; Salters Lane, Eccles, Manchester, England.

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

JANUARY, 1960 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

Throw-away Polyethylene Pillow Covers are now being manufactured for use in hospitals.

The strong, lightweight, polyethylene

Disposable polyethylene pillow covers for hospital use are convenient, easy to handle, help prevent cross infection.

covers are easy to handle... are disposed of when the cover is changed. The Manufacturer reports the pillow slips reduce danger of cross infection, eliminate autoclaving and help avoid waste. In addition, the slips may be used as disposable containers for contaminated objects. The manufacturer packages the product in pop-up dispensers containing 500 covers.

Polyethylene Bag-in-Box Packaging has significantly lowered shipping costs and improved the efficiency of a mid-western creamery.

The company reports it now ships 50 to 55-lb. containers of dairy products in 3-mil polyethylene bags packed in corrugated cartons in place of previously used returnable 10-gal. cans. Use of polyethylene helped cut shipping and maintenance costs by 17%, and saved valuable storage space necessary for the metal cans.

Further benefits are: greater control over package weight, shelf-life of products is doubled, insect infestation is eliminated, and leakers are greatly reduced.

Bags are made from polyethylene tubing which are completely heat-sealed across top and bottom except for a 5-inch opening at one corner. The bags are filled through the opening which is then tied shut with tinned wire. A shipping line speed of 125 to 150 bag-in-box units per hour is reported.

Polyethylene Wins Awards In Packaging Competition

Packages consisting in whole or part of polyethylene won six of the top awards in the recent National Flexible Packaging Association competition. Awards were presented during the fall meeting of the NFPA at White Sulphur Springs, West Virginia.

First prize in the "Break-Through" category went to a food concern for a polyethylene-coated bag for a line of fruit-flavored "icicles". Among the other winners using polyethylene as a film, laminate, or coating were bags for: water softener, hybrid corn seed, potatoes, marshmallows, and a polyethylene wrapping for bread.

U.S.I. Forms International Company To Serve Polyethylene Markets Overseas

New Unit Will Provide Technical Service, Sales, and Market Information

A new European company has been formed by U.S.I. to handle the overseas sales of PETROTHENE polyethylene resins and to provide technical service to customers and help in developing markets for polyethylene products. The new unit will be called U. S. Industrial Chemicals Company-International, Division of Sales and Development Company of National Distillers and Chemical Corporation (International) S. A., located at Kirchenstrasse 13, Zug, Switzerland. Operations of the new subsidiary began during October of 1959.

Howard W. Woodham

Kenneth E. Cosslett

Well Equipped Facilities

A customer service laboratory will be an integral part of the new company. It will be completely equipped with processing and test equipment designed to meet European standards and operating conditions. The laboratory will be used to demonstrate processing techniques and for research and evaluation studies to help its customers develop new end-use markets and produce improved products. The laboratory will also include polymer testing equipment to insure product quality. The laboratory will service markets in the European countries, including the United Kingdom. Howard W. Woodham is the Manager of the new Technical Service Laboratory.

To Back Up Local Agents

Sales Manager of U.S.I.-International is Kenneth E. Cosslett, who has been U.S.I.'s Assistant Export Manager. According to Mr. Cosslett, U.S.I.-International's PETROTHENE resin sales will be made through its established representatives in European countries. The new company will be a supporting unit to help these representatives provide the close technical assistance which the polyethylene market demands.

Nuclear Reactors Use Polyethylene Plate

Polyethylene plate is used in nuclear reactors as a replacement for concrete in areas where weight and space limitations are of primary importance. Polyethylene plate exhibits excellent neutron-shielding capacity and is widely used for neutron-shielding protection on nuclear reactors.

Automatic equipment for uninterrupted extrusion of polyethylene plate is now producing 48-by-96-inch sheets of the plate at a rate of 6,000,000 pounds per year. It is extruded in thicknesses up to 1¼ inches from PETROTHENE 100 resins in both natural and specially compounded forms.

Critical properties of the polyethylene plate produced by the continuous extrusion process are reported to be equal to or exceed those of plating produced by compression molding methods. The chief advantages of forming polyethylene plate by extrusion are a high rate of production and guaranteed freedom from voids.

Duck Hunters Use Polyethylene Film

Duck "ponds" of polyethylene film are being used by a number of hunters throughout the country.

Photo courtesy True, The Man's Magazine

The novel man-made "ponds" are built by spreading polyethylene film in fields where ducks feed on their southward journey each fall. The sun's rays reflect from the polyethylene film which appears to be open water in a frozen field. A spread of decoys further heightens the illusion.

Hunters say by the time ducks realize their mistake, it's usually too late!

DO YOU HAVE a new polyethylene packaging development you'd like the industry to know about? Make it routine to send your information on new developments to U.S.I. POLYETHYLENE NEWS.

Address the Editor,
U.S.I. POLYETHYLENE NEWS, U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, N. Y.

U.S.I.

Vol. V, No. 1

POLYETHYLENE PROCESSING TIPS

CONTROL STOCK TEMPERATURE TO IMPROVE FILM PROPERTIES

Polymer or "stock" temperature is one of the most important variables in extruding polyethylene. Fluctuating polymer temperatures can cause undesirable variations in film properties and operating conditions.

With blown film, for example, poor temperature control may result in such film defects as non-uniform gauge, width fluctuation, variable optical properties, wrinkles in the finished roll, pinholes, and bubble rupture or collapse during extrusion.

Determining Optimum Temperature

The effect of stock temperature on three important film properties – haze, gloss and transparency – is shown in the accompanying graph. Within the temperature range necessary to maintain a bubble, increasing stock temperature results in improved optical properties. The optimum stock temperature, from an optical standpoint is, therefore, the maximum temperature at which a uniform bubble can be maintained.

When the optimum stock temperature is determined for a particular set of conditions, it must be held constant. Any lowering will cause deterioration in optical properties, and any increase will result in poor bubble control and eventually in bubble collapse.

How the Resin Is Heated

Stock temperature is maintained by two heat sources:

1. Uncontrolled heat produced by the action of pressure and friction within the extruder barrel. This is the primary heat source.
2. Controlled heat supplied generally by an external electrical heating system. This is the secondary heat supply.

The electrical heating system used in most extrusion operations consists of a heat source (resistance heaters), a number of thermocouples to sense the temperature of the barrel wall, and temperature-indicating devices such as deflection-type galvanometers or potentiometers. The potentiometer, which measures the voltage supplied to the heater, is more sensitive than the galvanometer, which measures the current passing through the resistance wire. However, since galvanometers are less expensive, they are in more common use.

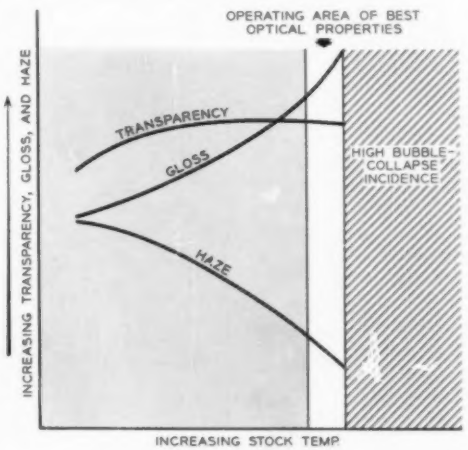
Controlling Temperature

Heaters should fit snugly against the barrel surfaces to insure good heat transfer. Loose heaters will result in loss of heat as well as uneven heating.

When a thermocouple needs changing, it is important to replace it with one of the same length and composition. Galvanometer-type temperature indicators are calibrated for a specific amount of external resistance, including that of the thermocouple. If a thermocouple of different lead length and composition is used as a replacement, the galvanometer must be re-calibrated accordingly.

The primary heat produced by action within the extruder barrel increases with operating time. This is the result of screen pack contamination, with attendant build-up of pressure and friction.

Unless this additional heat is compensated for, stock temperatures will rise although the thermocouple and galvanometer settings are unchanged. The external heating controls do not respond because the temperature of the wall measured by the thermocouple differs from the actual temperature of the resin melt itself. However, lowering the thermocouple settings will reduce the heat input from the external heaters and will tend to offset this additional internal heat and keep stock temperature constant.



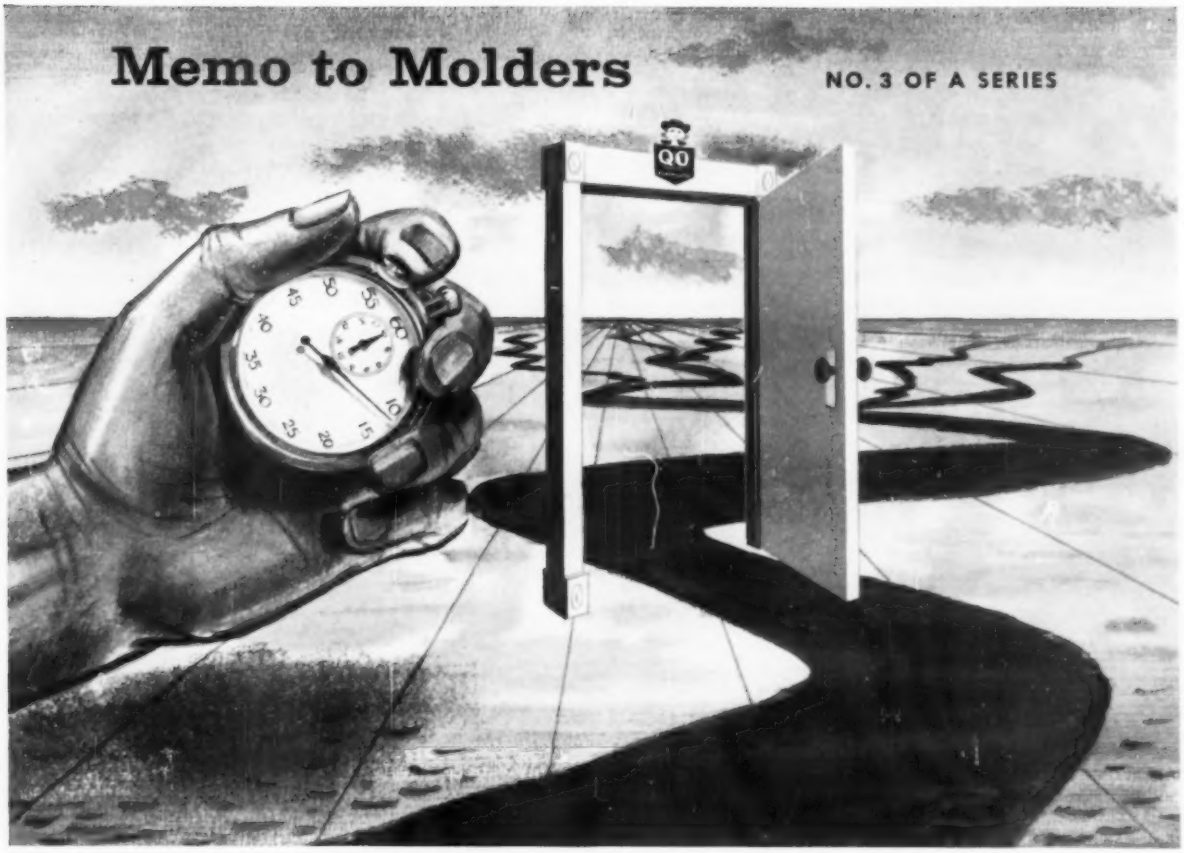
Accurate Melt Temperature

The operator can obtain a better indication of actual melt temperature by means of a thermocouple which extends through the die or collar wall into the melt stream. He can also attach a simple pressure gauge to the extruder barrel (see U.S.I. Polyethylene Processing Tips, Vol. IV, No. 5). This gives a constant check on internal pressures affecting polymer temperature.

For good temperature control it is necessary to recognize a difference between actual stock temperature and measured temperature; this temperature difference increases as pressure goes up. Using experience as a guide, the operator can make periodic adjustments of control temperature to keep actual polymer temperature constant.

The effect of stock temperature on film properties is vital, and a variety of problems may turn up in connection with efforts to keep the optimum temperature constant. We, therefore, invite you to ask for the cooperation of U.S.I. Technical Service Engineers whenever control problems arise.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities



Artist's concept of how QO furfural gives long flow, short molding cycle and broad range to phenolic resins.

IN PHENOLIC MOLDING, WHAT'S QO® FURFURAL DOING FOR YOU?

Plenty, wherever it is used. For example, here are a few of the ways QO furfural is broadening the range of usefulness of phenolics:

QO Furfural shortens over-all molding cycle, which means money for you.

QO Furfural furnishes long flow, where that quality is needed.

QO Furfural improves product finish, which your customers want.

QO Furfural eases the problem of handling stiff compounds.

Chances are you will seldom be aware of the QO furfural your supplier uses—but you'll be thankful for the results it delivers.

QO Furfural is a highly purified synthetic organic chemical, used in manufacture of nylon, premium lubricating oils, synthetic rubber and quality grinding wheels. Your molding powder supplier uses this pure chemical to achieve special properties and that's why its very presence can be looked upon as an assurance of extra value and quality.

The Quaker Oats Company does not manufacture furfural phenolic molding compounds. However, we will be glad to furnish suppliers' names.

The Quaker Oats Company
CHEMICALS DIVISION
QO
CHEMICALS

The Quaker Oats Company

CHEMICALS DIVISION

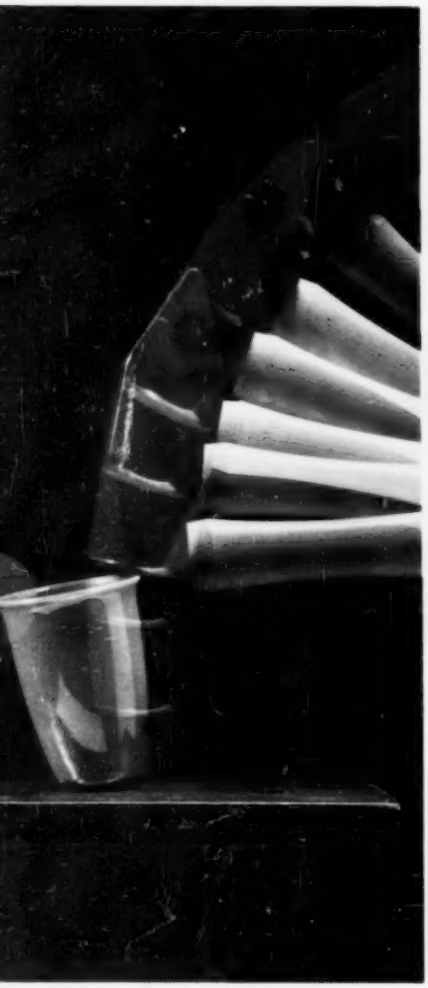
334G The Merchandise Mart, Chicago 54, Illinois

NEW MERLON® NEW

POLYCARBONATE

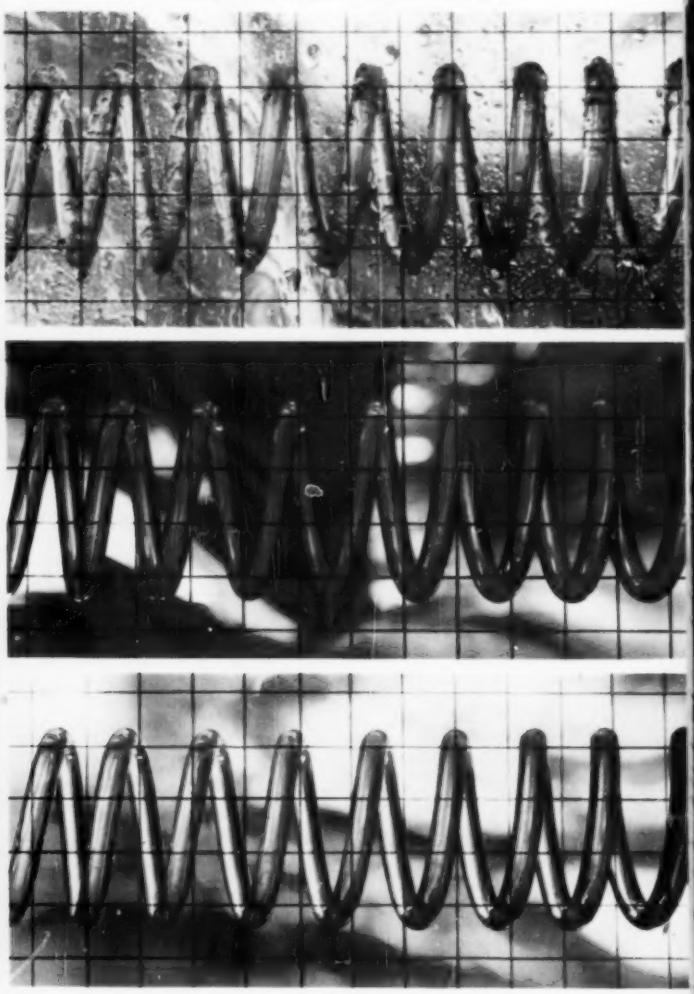
L MECHANICAL STRENGTH

(in. notched Izod impact strength—see table)



SUPERIOR DIMENSIONAL STABILITY

(Example: Low Water Absorption—see table)



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GOOD ELECTR

(Example: 440 volts/mil diele

ne new thermoplastic
h the most profitable
bination of functional
gineering properties!

New MERLON combines in one material the most sought-after engineering properties near the ultimate specification level. It is not only a new thermoplastic resin, but represents a new approach to the whole material specification assignment in industry.

In addition to the major properties illustrated, MERLON polycarbonate is transparent, has low water absorption, is non-staining, self-extinguishing, odorless and tasteless. It can be fabricated by injection molding, extrusion, and vacuum forming on standard equipment. Fin
gloss, can be machin
bonded with approp
or sealed. Plasticiz
pigments can be ad
or opaque colors.

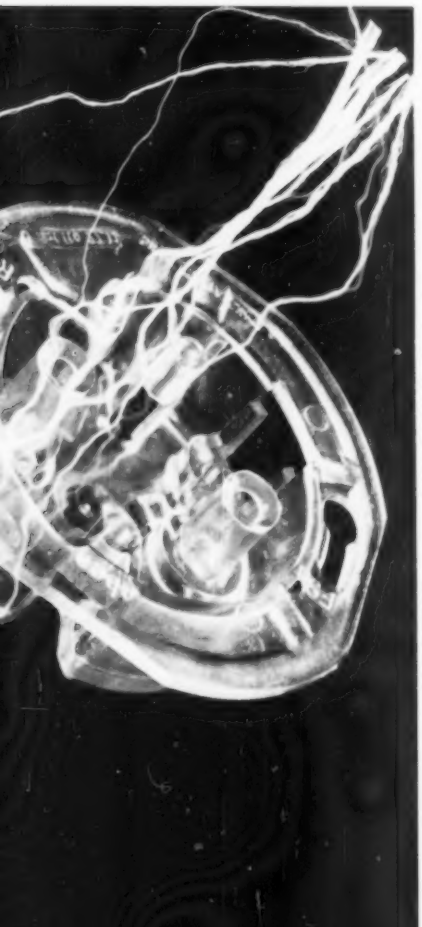
Examine MERL
chart under the fla
against "problem"
It's very possible

NEW NEW MERLON® NEW NEW

POLYCARBONATE

CTRICAL PROPERTIES

dielectric strength, short time—see table)



PROPERTIES OF MERLON® POLYCARBONATE RESIN

PROPERTY	ASTM NO.	VALUE*
MECHANICAL		
Impact strength, Izod (notched)	D-256 (½" x ½")	2 to 3 ft-lb/in.
	(½" x ⅛")	12 to 16 ft-lb/in.
Tensile strength and yield point	D-638	8,000-9,000 psi
Elongation, at yield	D-638	5-6%
Elongation, ultimate	D-638	60-100%
Compressive stress at yield point	D-695	12,000 psi
Deformation under load	D-621	0.14%
Flexural strength	D-790	11,000-13,000 psi
Modulus of elasticity		
Tension	D-638	2.8-3.2 x 10^5 psi
Flexural	D-740	3.2-3.4 x 10^5 psi
Rockwell hardness	D-785	R 115
ELECTRICAL		
Dielectric constant	D-150	
60 cycles		2.95
10^6 cycles		2.90
Dielectric strength, short time	D-149	440 V/mil
Dissipation factor		
60 cycles	D-150	0.0007
10^6 cycles		0.0100
Volume resistivity		
Dry		1.2 x 10^{16} ohm/cm
4 days at 80% rel. humidity		9 x 10^{14} ohm/cm
Arc resistance	D-495	12 sec

PROPERTY	ASTM NO.
THERMAL	
Heat distortion	D-648
264 psi	
66 psi	
Specific heat	
Coeff. of expansion	D-696
Melting temperature	
Crystalline melting temp.	
Flammability (in./min)	D-635
MISCELLANEOUS	
Specific gravity	D-792
Refractive index	D-542
Clarity	
Water absorption 24 hr immersion	D-570
Effect of sunlight	
Outdoor aging	

*These values have been obtained under standard ASTM conditions. As averages, these values do not necessarily material specifications.

Finished parts have brilliant surface achined, sawed, cut or stamped; easily opropriate solvents; readily heat welded sticizers are not necessary; dyes and e added for a full range of transparent s.

RLON's qualifications shown in the flap of this advertisement—check it m" materials you may now be using. ble that MERLON is the optimum material you've been searching for. MERLON's full range of engineering properties opens the door to a wide variety of redesign possibilities that could mean lower cost and improved performance of your products and components.

Test sample quantities of this new resin are now available for your development studies. Test application data and property tables (based on more than five years of research and development work here and abroad) are available. Mail coupon for your copy today.

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ngth 10,200 psi at -60°C, 8200 psi at 100°C)

Mobay Products Company
subsidiary of
Mobay Chemical Company

MORE INFORMATION

This Month In Brief

"The Outlook for 1960" is the subject of both the Editorial in t issue and the group of 10 prediction-statements by spokesmen fo selected materials supplier companies that leads off the article section.

Editorially, we look upon 1960 to continue the industry's "plea habit" of setting a new record high each year. In 1960, the plas industry will consolidate its past gains in usage and will develop enter into new fields of application usage.

The prediction-statements are equally optimistic for this yea with special mention being made melamine and urea moldings, p ethylene film, industrial nylon moldings, custom-tailoring of po mers and copolymers, linear polyethylene for containers and to and polycarbonates. In fact, 1960 is expected to result in a tota plastics output of more than 6.25-billion pounds.

Some notes on the Technical Articles appearing this month fol

The first article, "Automatic Plunger Molding," describes wh a large molder has done to automate his plant in order to plunge mold thermoset materials competitively in every respect.

"How Teflon Improves Surgeons' Heart-Lung Machine" shows the plastic components enable the machine to be used in critical heart surgery operations.

A thoughtful appraisal of American industry and its relation t foreign industrial philosophy is given in L. G. Moser's Guest E orial this month. He notes that Europeans have taken the lead f the U. S. in both injection molding and blow-molding extrusion, working conditions for the employees are still far below our sta ards, and entry into management well-nigh impossible.

Three Engineering Forum columns in this issue deal with Co sion & Transfer Molding, Reinforced Plastics, and Moldmaking Tooling. The first has the explanatory sub-title, Automate to S Alive. The second covers the potentials for reinforced plastics underseas explorations. The third column describes the latest developments in construction of an injection mold.

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TICS TECHNOLOGY

"Smooth, trouble-free production straight years" is attributed to use of 1143 by Malcolm Pearden, Plant Su dent of Cutter Boats, Inc., shown left ing the lay-up of a fiberglas hull.

...made with Polyester Resin

AMESTER 1143

The Cutter Boats, Inc. of Tell City, Indiana, proudly advertises its rakish, sports-car inspired line of high-performance cabin cruisers and runabouts as "The Finest in Fiberglas".

And, with equal pride, American Alkyd Industries supplies the Amester 1143 for "The Finest in Fiberglas".

Thixotropic Amester 1143 has good wetting qualities, extremely rapid tack-free cure with low exotherm and less shrinkage, high bond strength, no gel time drift, and deteriorate in bulk storage . . . characteristics wh production and assure consistent quality in Cutter fiberglas designs.

Afloat and ashore, American Alkyd Industries plastics, backed by its reputation for uniformity, technology and service, are changing concepts performance.

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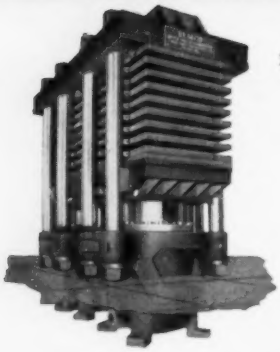
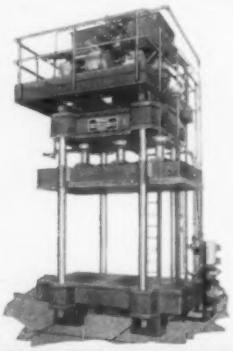
SOLVE YOUR PRODUCTION PROBLEMS...





WITH EEMCO

. . . CUSTOM DESIGNED MACHINERY FOR THE RUBBER & PLASTICS INDUSTRY

It costs no more for ERIE ENGINE AND MFG. COMPANY to design and build presses for compression, transfer, laminating and reinforced plastics molding in any tonnage, stroke, daylight or platen size and any closing speed with pumping units if desired . . . engineered to fit your operation with automatic or semi-automatic controls. EEMCO can supply you promptly and dependably with rubber and plastics processing machinery . . . designed to your own special requirements at no extra cost. EEMCO mills and presses are designed and engineered to eliminate production problems and lags. Send EEMCO your specifications and requirements for comparison.

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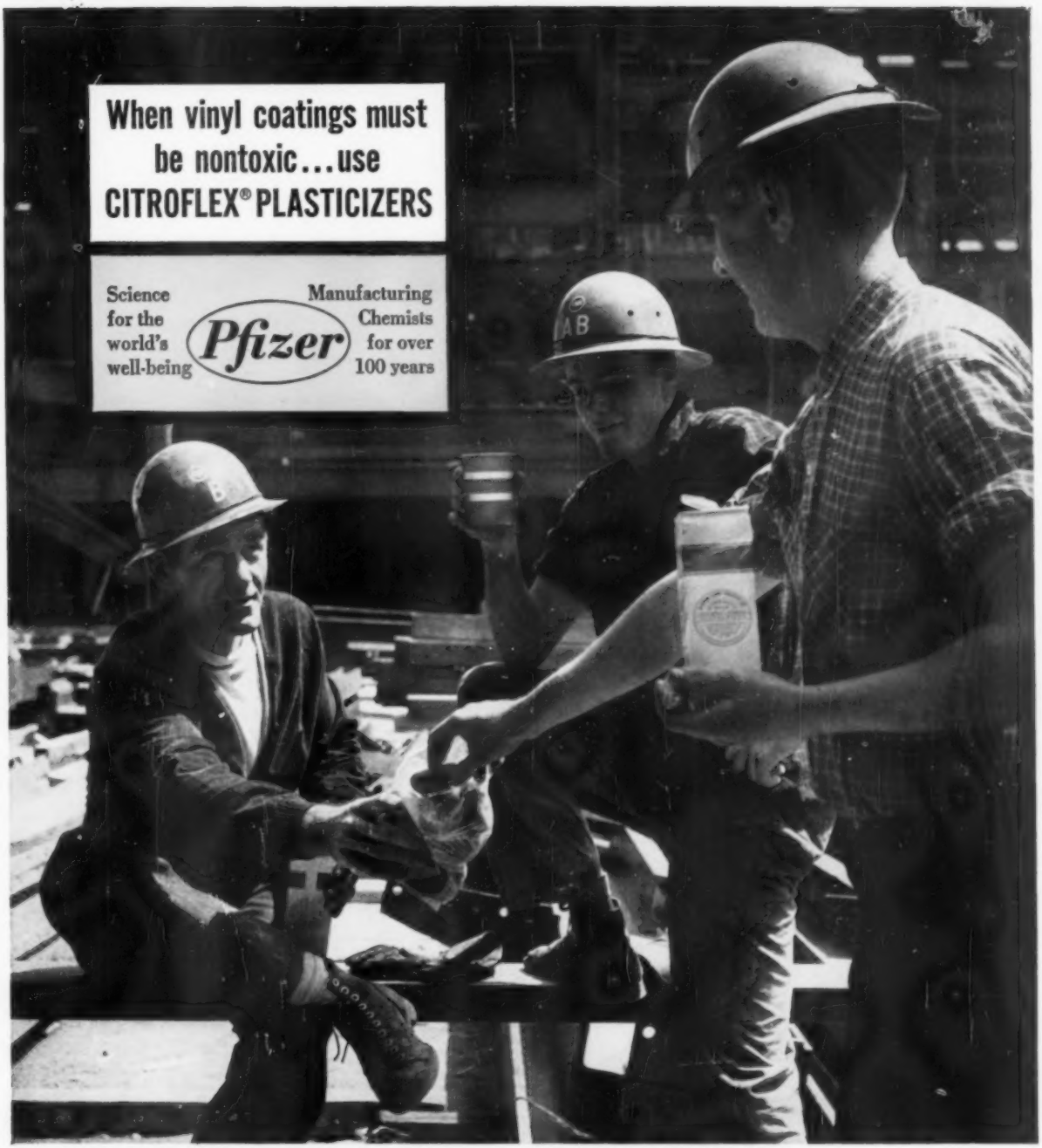
When vinyl coatings must be nontoxic...use CITROFLEX® PLASTICIZERS
Science for the world's well-being
Pfizer
Manufacturing Chemists for over 100 years

PLASTIC COATED CUPS • FOOD WRAPPINGS • FATTY FOOD CONTAINERS

• For many plastic coatings, packaging films and plastisols where toxicological safety is important Pfizer Citroflexes are the best possible plasticizers ...and surprisingly economical!

Odorless, as well as nontoxic, Pfizer Citroflex A-2 and A-4 have been accepted by the Food and Drug Administration for use in packaging *both fatty and non-fatty foods.*

CITROFLEX A-4 (Acetyl Tributyl Citrate) for polyvinyls—shows excellent results in plasticizing vinyl films for meat wrapping, vinyl coatings for food containers and hot drink cups, vinyl plastisols for bottle crown liners and food jar sealing rings.

CITROFLEX A-2 (Acetyl Triethyl Citrate) is especially suited for cellulosic packaging materials used for doughnuts, processed meats, etc.

When you need a *safe,* efficient, *economically-priced* plasticizer, take a look at the Pfizer CITROFLEXES.

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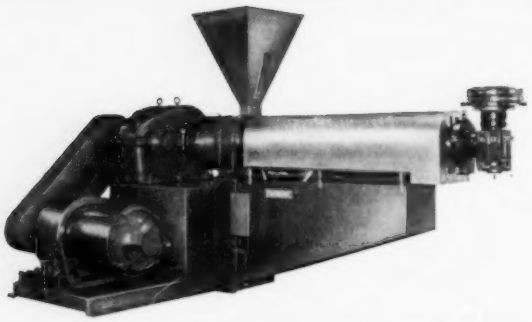
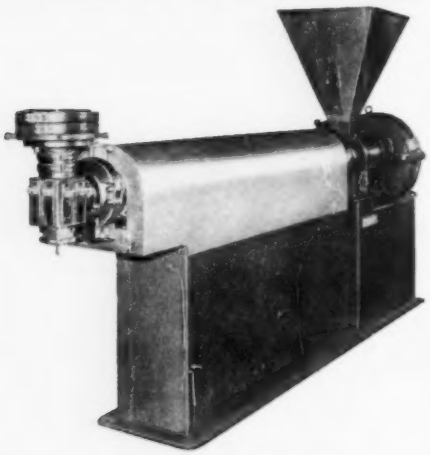
STERLING



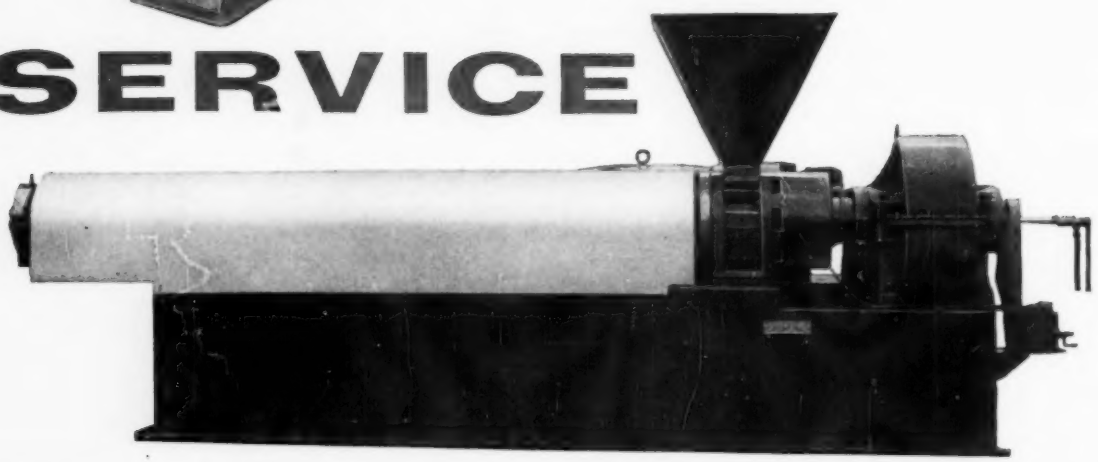
The Sterling Extruder is a superior product which only long experience in the plastics industry could have made possible. Sterlings are available in 1½" through 6" sizes with L/D ratios of 21:1, 24:1, or 30:1.

PERFORMANCE



There are also available—completely packaged units and installations for a variety of standardized and specialized requirements. For full details, write today to Mr. L. D. Yokana, President, Sterling Extruder Corp'n. 1112 Baltimore Avenue, Linden, N.J. WAbash 5-3908.

SERVICE



PRODUCTION

STERLING EXTRUDERS — *"Designed by plastics men for plastics men"*

DESIGNED IN CELANESE FORTIFLEX...

SILVERWARE CYLINDER FOR COMMERCIAL DISHWASHERS

MOLDED BY NEW PRODUCTS COMPANY, INDIANAPOLIS, IND.
FOR STERIL-O-MATIC COMPANY, INC., INDIANAPOLIS, IND.

Steam resistant sterilizer is quiet, tough . . . in Fortiflex

The unique properties of Celanese Fortiflex combine in this design to produce a superior product with plus advantages: lightweight, high strength, ability to withstand hospital sterilization methods, easy moldability, and moderate cost.

To meet a variety of design and production problems, Fortiflex A is available in four melt indexes. Fortiflex B, a new linear polyolefin, is now available in production quantities. For more information, use coupon.

Celanese Corporation of America, Plastics Division, Dept. 143-A, 744 Broad Street, Newark 2, N. J. Canadian Chemical Company Limited, Montreal, Toronto, Vancouver. Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y. Celanese® Fortiflex®

Fortiflex...a Celanese plastic

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES OF FORTIFLEX

Properties of Fortiflex "A" Related to Melt Index

PHYSICAL PROPERTIES ASTM METHOD	UNITS	FORTIFLEX RESINS A-20	A-70	A-250	A-500
Melt Index D-1238-52T	—	0.2	0.7	2.5	5.0
Heat Distortion Temp. (66 psi) .. D-648-45T	°F.	185	185	180	180
Brittleness Temp. D-764-52T	°F.	—200	—180	—160	—100
Impact Strength, izod ..... D-256-54T (1/8" x 1/2" injection-molded bars)	ft. lb./in. notch	23	18	13	3
Tensile Strength, Max., 0.2 in./min. D-638-52T	psi.	3700	3600	3500	3300
Elongation, First Tensile Yield Point D-638-52T	%	25	25	25	25

Properties of Fortiflex "A" Not Affected by Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	VALUE
Density		g./cc.	0.96
Refractive Index	D-542-50	n_D^{25}	1.54
Hardness, Shore D	D-676-49T		65
Stiffness	D-747-50	psi.	150,000
Water Absorption ..... (1/8" specimen, 24 hr. immersion @ room temp.)	D-570-54T	%, wgt. gain	<0.01
Flammability	D-635-44	in./min.	1.0
*Mold Shrinkage, length		in./in.	0.03 to 0.05
width		in./in.	0.02 to 0.04

*Measured on injection molded tensile bar. Mold shrinkage depends on part design and molding conditions.

Celanese Corporation of America, Plastics Division,
Dept. 143-A, 744 Broad Street, Newark 2, N. J.

Please send: ☐ more information on, ☐ test quantities of Fortiflex.

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Company _____

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Grueling use-test pits monomeric vs. polymeric plasticizers

Some years ago a vinyl upholstery manufacturer decided to field-test new materials for truck and transportation upholstery using a wide variety of monomeric and polymeric plasticizers, including Plastolein 9720. To compare *permanence* and *durability,* the different materials were installed on city bus drivers' seats. Here, seat upholstering would certainly be exposed to extraordinary abuse almost around the clock . . . continuous rubbing and flexing, city grime and grit, oil and grease.

After a certain period of time, all the upholstery containing monomeric plasticizers had failed. But all those made with polymerics, including Plastolein 9720, were still in excellent shape. With this evidence, the manufacturer concluded that only a polymeric plasticizer would meet its standards for truck and transportation upholstering, and protect its reputation. And Plastolein 9720 was chosen on the basis that it was the *lowest cost of all the fine polymerics tested.*

Today, Plastolein 9720 is *still* the lowest cost polymeric plasticizer, and is *still* being used by this and many other manufacturers in such heavy-duty goods. Why not check 9720 yourself? Write Dept. Q-1 for literature and sample.

PLASTOLEIN®
plasticizers

Emery Industries, Inc.

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JANUARY, 1960

PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

EDITORIAL:

The Outlook for 1960

By every indication, the domestic plastics industry in 1960 will continue its "pleasant habit" of setting a new record high each year. While final government total figures on 1959 are not yet available, it seems assured that production of plastics raw material was approximately 5.5-billion pounds (an increase of about 25% over 1958 totals), with both polyethylene and vinyl going over the one-billion-pound level.

In recent years, the industry has followed the practice of building new materials plants at a great pace, resulting in over-capacity one year and followed by catching-up the next year when new and expanded fields of application take care of the excess or surplus production of the preceding year. By this system, 1959 was the over-production year and 1960 will be the catching-up year. With all the new polyethylene-producing plants last year, a surplus of polyethylene production resulted, but tremendous growth in film usage will spark the 1960 catching-up year.

•

Equally optimistic views for 1960 are expressed by ten materials supplier companies whose specially-prepared prediction statements by their spokesmen appear in this issue.

Taking these statements in alphabetical order by companies, L. J. Francisco, of American Cyanamid, foresees healthy growth of the melamine and urea molding industry in 1960, based on improvements in molding compounds, aggressiveness by molders, and more-educated tastes by the public.

Harry Krehbiel, of Catalin, also predicts growth in 1960, and foresees new developments this year in polyethylene film, nylon moldings for machinery parts, custom-tailoring of resin polymers and copolymers, and resins for natural and synthetic materials.

An acceleration of the trend towards blow molding of linear polyethylene in 1960 is seen by E. W. Ward, of Celanese, with emphasis on the container and toy fields.

Viewing the potentials for polycarbonates, A. E. Schubert, of G-E, expects a growth year for plastics in 1960.

E. E. Winne, of W. R. Grace, predicts a use volume of 160-million pounds for high-density polyethylene this year.

Basing his prediction for 1960 on new and expanding markets for polyurethanes, J. D. Mahoney, of Mobay, looks for a banner year for the plastics industry.

An optimistic prediction for 1960 is also made by George Wash, of Phillips, who sees great use-strides for polyethylene.

H. R. Reichhold, of Reichhold Chemicals, predicts an annual sales volume of $30-billion in the next few years.

D. P. Jones, of Shell Chemical, expects a challenging and rewarding year in 1960 for the plastics industry.

J. D. Benedito, of Union Carbide Plastics, expects 1960 to give a total plastics output of more than 6.25-billion pounds.

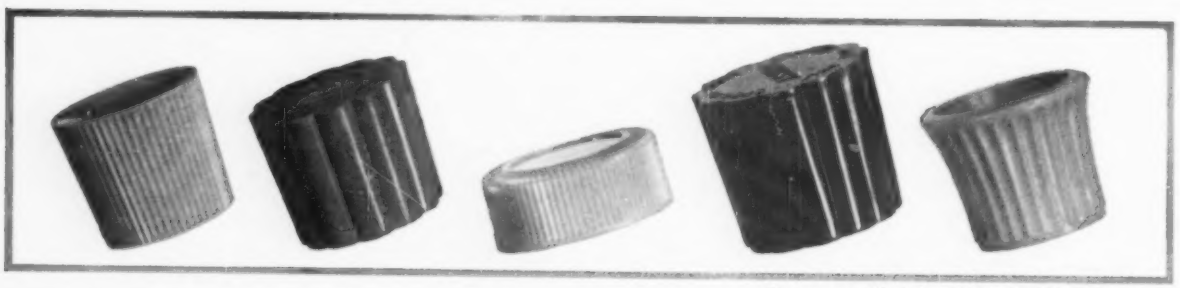
•

Editorially, we view 1960 as the year for consolidation of past gains in applications for plastics, and the development and entry into new fields of plastics usage.

Arthur M. Merrill
Editor

Boxes designed by Avon, molded by Garmold, Inc.

TMD-9001 impact styrene



Closures molded by Mack Molding Co., Inc.

works production magic

The outstanding molding characteristics of TMD-9001 can work wonders on your production line. It has a wide molding latitude for parts injection molded with large or pin-point gates. It flows easily in thin or long flow sections, and is particularly suitable for the complex shapes that tax machine capacity.

Look closely—these boxes molded from BAKELITE Brand medium impact styrene TMD-9001 all have basically the same design. But by changing the colors of the base, ring and lid, and varying other details Avon Products gets a different and glamorous package for any number of their "Beauty Dust" fragrances.

This application, and possibly yours, demands exceptional dimensional stability, perfect color matching, high gloss, hard surface, impact strength—even in thin walls.

TMD-9001 is just one of a complete variety of BAKELITE Brand impact styrenes offered in a range of impact strengths, heat resistance values, particle sizes and colors. Bakelite impact styrenes provide fast set-up and wide molding latitude—everything for increased production and greater profits.

Use them in products ranging from toys and radio cabinets to housewares and appliance parts. Learn about them from our free MOLDING NEWS, "The Test of Impact." Write Dept. AQ-06G, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 7.

UNION CARBIDE

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What's New in Processing

The Jackmeyer Corp. of Long Island City, N. Y., has developed a pressure sensitive blister which can be applied to a printed card by slight hand pressure. No special packaging equipment is required, nor must the card be treated. Called the Magi-Stick Blister PAC, it has a shelf life of over two years.

•

Chemplast Inc., East Newark, N. J., has developed a technique called Chemforming, which permits thin-wall molding of Teflon. Powder is fed through narrow openings into the dies, and pressure is applied evenly.

•

Enamelstrip Corp., a subsidiary of National Steel Corp., has developed a process for bonding a highly decorative, abrasion-resistant plastic coating to long, continuous coils of strip steel. Previously, pre-decorated metals were available only as cut sheets which involved costly handling procedures and material waste. The transparent polyester coating, which is 0.0003-inch thick, is said to be 10 times more abrasion resistant than materials currently used as table tops and counters. Pigment is added to the adhesive.

•

Recent processing patents include the following: W. P. Murphy to Dade Reagents, Inc., on a process for making tubes—**2,876,496.** It involves closing the end of a small-diameter plastic tube by forcing the flared end under heat through a die and compressing the taper.

P. Alexander to Union Carbide Corp. a process of melt-extruding plastic film—**2,876,497.** A film-forming composition is heated to a plastic, semi-fused state; delivered to a die orifice in which the temperature of the die lips is sufficiently high to fuse the plastic; extruding the mass in a molten state; and drawing it into a thin section immediately upon leaving the die.

H. A. Nason to General Electric Co., a method of forming a reinforced plastic pan—**2,876,498.** A rectangular-shaped wire reinforcement is supported at the sides and corners of the mold cavity and a sheet of thermoplastic is laid over it. The pan is then made by the vacuum forming method.

C. E. Slaughter to Extruded Plastics, Inc., a method of manufacturing collapsible tubes —**2,878,513.** A heated, solid plug of thermoplastic is confined at the peripheral lip and the other end is drawn to form an elongated thin-walled tube with a closed end.

G. V. Mumford and L. D. Soubier to Owens-Illinois Glass Co., a method of forming a succession of hollow plastic articles—**2,878,520.** The neck is formed by injecting heated plastic from an extruder cavity through an annular orifice opening into a neck mold with mandrel.

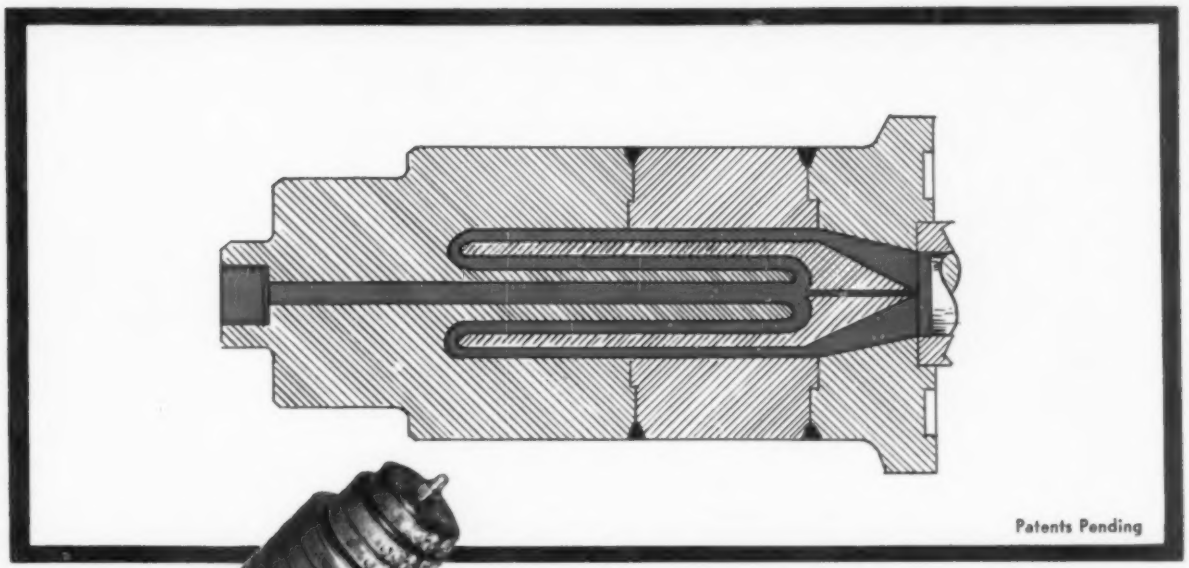
•

Following are some recent processing articles:

"Low Pressure Injection Molding" by Gordon Cooper appeared in the November issue of the SPE Journal. The described method is said to offer the advantage of a very uniform melt. There are some interesting production possibilities, since in theory, there is no limit to the shot capacity which can be handled.

"Problems in Molding Anisotropic Plastics" by Howard S. Malby appeared in the November issue of Western Plastics. Properties of anisotropic plastics vary according to the direction in which they are measured. They have different shrink factors which can cause warpage if radial flow from a single gate is present predominantly. Parallel, balanced, or non-radial flow as obtained by multiple or flash gating will reduce or eliminate this warpage. Uniform control of die temperatures also reduces warpage, though the mechanism is not known, and will also improve stress crack resistance and impact strength in the area of the gates.

VRF Vented Reverse Flow Heaters



Patents Pending

Leading injection molders know— it's what happens INSIDE the heater that really counts!

Here's ultimate proof of IMS Leadership in heating cylinder design! The new exclusive VRF Degassing principle automatically overcomes many common molded-in defects. It's brought to you by the same cylinder engineers who pioneered the IMS Standard Uniform Design All-Welded Replacement Chamber in 1949. Note how the exclusive vent hole allows trapped, compressed gases to escape out of the melt area just prior to injection. This hot bleed-back speeds melting of cold granules, and often lowers pressure requirements by lubricating the spreader tip with soft plastic. You gain the advantages of precompression with no moving parts!

Cylinder corrosion on cellulosics is virtually eliminated by gas relief. Production time between clean-outs on Vinyl is greatly extended.

Pressure equalizing bleed-back gives automatic part weight control without a feed weigher.

VRF reduces burning because internal storage tube keeps material inventory away from heat source. Remember! It's what takes place INSIDE a heating cylinder that really counts!

IMS

SPECIAL PURPOSE REPLACEMENT
HEATING CYLINDERS FOR ALL
INJECTION MOLDING MACHINES.

INJECTION MOLDERS SUPPLY CO.
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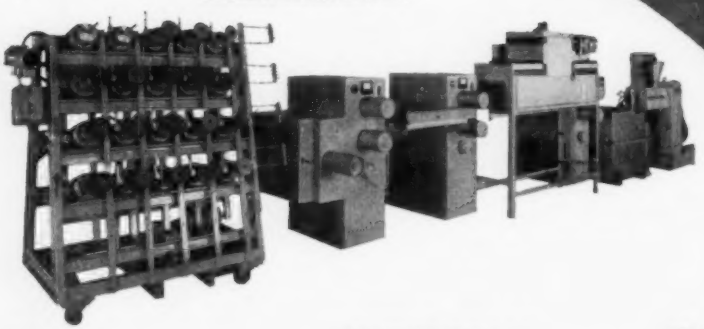
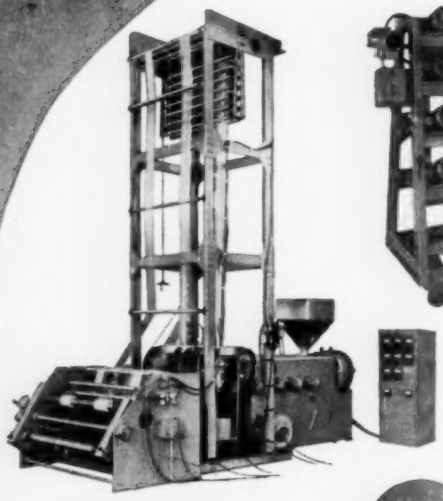
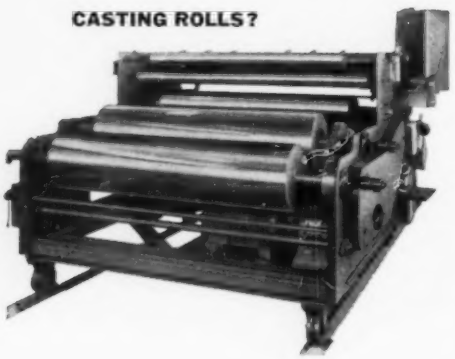
MONOFILAMENTS?

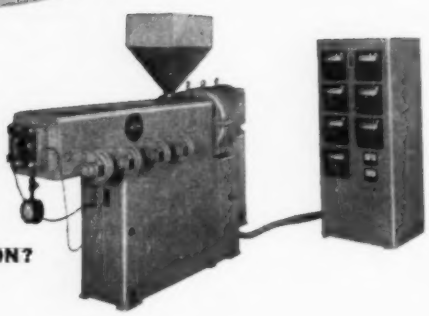




SYSTEMS?

CASTING ROLLS?





EXTRUSION?

plastic production problems on your mind?

SYSTEMS—Extruders with twin dies, overhead forming canopy and turret type winder. Sheeting lines of extruder, casting roll unit with turret wind, automatic torque control and high-speed cut-off.

MONOFILAMENTS—Complete packaged monofilament units in all sizes.

MPM HAS THE ANSWERS

CASTING ROLL UNITS—Chrome plated casting rolls, rubber and aluminum pull rolls, trim knives, constant tension double turret winder. For high-speed casting of Polyethylene or Polypropylene in 30", 60", 72", 76", 80" or special widths.

EXTRUDERS—Vented and non-vented with screw sizes from 1" to 12" diameter. All with steel cylinder barrels lined with Xaloy 306 in lengths 16, 20, 24 and 30 times screw diameter.

DIES—Of all types—for blown or sheet film, rods, tubes, pipes, monofilament, and special dies for any extruded product from any plastic material.

Check your needs and contact Modern Plastic Machinery Corporation for complete specifications and product information:

- ☐ Thermoplastic Extruders
- ☐ Teflon Extruders
- ☐ Silicone Rubber Extruders
- ☐ Laboratory Extruders
- ☐ Casting Roll Units
- ☐ Sheeting Lines
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Improve epoxy resin 5 ways with MOD-EPOX

MONSANTO'S NEW MOD-EPOX...

REDUCES VISCOSITY	of liquid epoxy resins by as much as 75%
IMPROVES BOND STRENGTH	Tensile Shear-bond Strength* / Without MOD-EPOX / With MOD-EPOX Aluminum-Aluminum 1880 psi 2590 psi up 35% Steel-Steel 2000 3060 up 50% Glass-Glass 2750 4900† up 75% *Adhesive formulation available on request. †Cohesive failure of resin. Adhesive bond intact.
SPEEDS CURE	Reacts chemically with epoxy resin and reduces curing-agent requirements to about ⅔ of the usual concentration
BOOSTS DIMENSIONAL STABILITY	under compressive load
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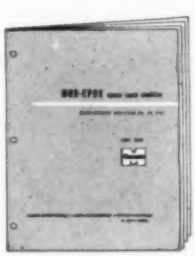

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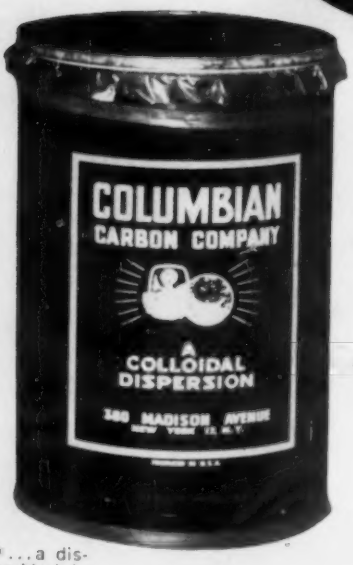

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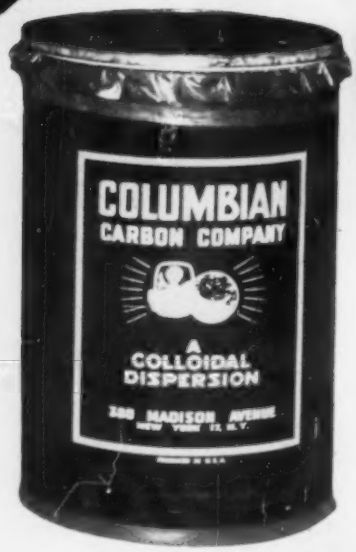

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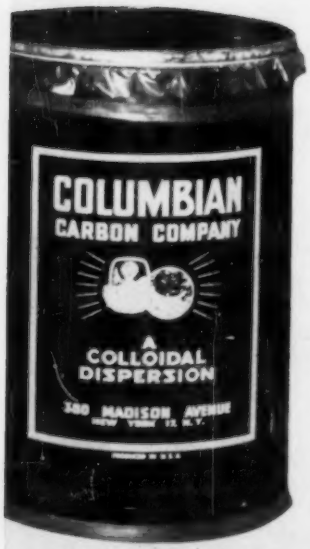

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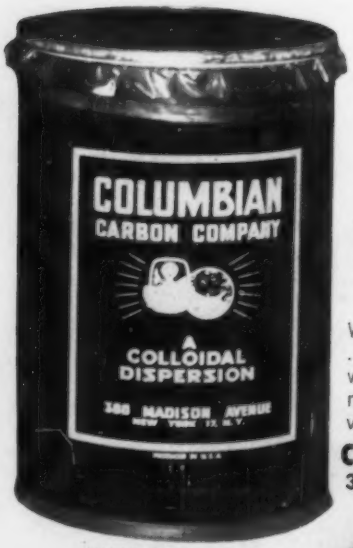

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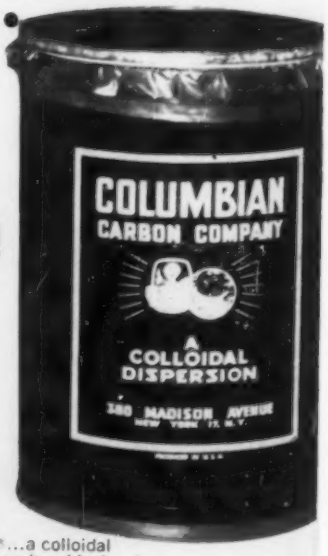

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- Fire-safe umbrella roof
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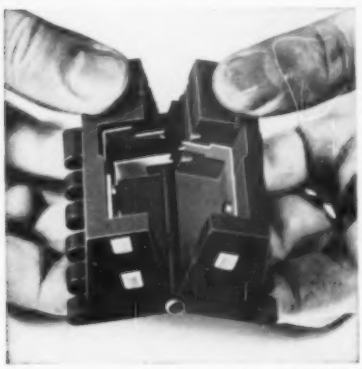
Speaking of Stability

This is one piece of a small roomful of high-class electronic hardware.

The hardware represents man's latest and most sophisticated effort to cram into 123 square feet of floor space the means of discovering in one day which of 15,000 small semiconductors will work in a given set of circumstances, and which ones won't.



STROMBERG-CARLSON

This piece carries the semiconductor through the test gantlet. Around and around it goes, over six electrical-test hurdles, through an oven at a blistering 200°C, and back again for another trip.

Few materials have what it takes to survive this merry-go-round with virtually no change in size, shape, strength, toughness, and insulation values. Here you see one that does—a Durez diallyl phthalate molding compound filled with glass roving.

This is just one of the family. As a class, Durez diallyl phthalate compounds offer unsurpassed freedom from cold flow and creep, high reproducible arc resistance, a chilly indifference to moisture.

You get more information on them by talking over the intended application with your molder. He can describe them far more glowingly than do our data sheets, which we'll gladly send you.

Symbol

When promoters of the American National Exhibition in Moscow displayed a cross-section of America in old Sokolniki Park under flaring umbrellas of glass fiber and Hetron,® they built even better than they knew.

For the tapering 16-foot columns arching into 15,000 square feet of fire-resistant roof, architect George Nelson used our Hetron polyester. One of the reasons: Hetron does not support combustion; it requires no additives, as do other polyesters, to make it resist fire.

OWENS-CORNING FIBERGLAS CORP.

Another reason: strength. Structural engineers learned that winds in Moscow sometimes reach 60 mph. So they tested five of the lily-like umbrellas at Mitchell Field, N. Y., by blasting them with 60-plus-mph gusts from the twin propellers of an Air Force bomber.

The payoff: a coup for the U. S. when a sudden Moscow storm caused aluminum arches to buckle badly in the sparsely attended Soviet exhibition next door. In the jam-packed U. S. showcase, Hetron stood fast.

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It discusses products, from closures to computers, from plastic portholes to potentiometers. It shows you how Durez plastics are used.

Though its scope is the whole world of products and product design, you can read it through in 10 minutes. Thousands of people tell us it helps them keep up to date, in an age when keeping up to date can be a full-time job.

We'd like to send *Durez Plastics News* to you. May we? If you'd like to receive it regularly, just check the coupon.

For more information on Durez materials and services mentioned above, check here:

- ☐ Data file on Hetron, including list of fabricators
- ☐ Diallyl phthalate molding compounds (data sheets)
- ☐ *Durez Plastics News* (bimonthly bulletin)

Clip and mail to us with your name, title, company address. (*When requesting samples, please use business letterhead.*)

DUREZ PLASTICS DIVISION

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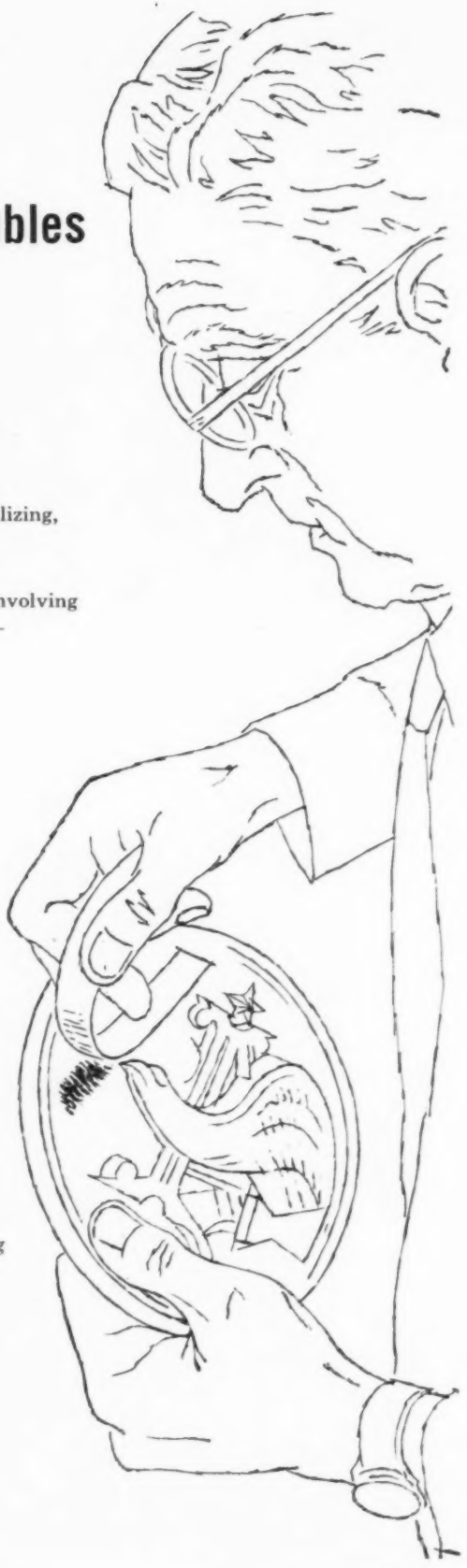
HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

Despite the best of care...

Who hasn't had some troubles with vacuum metallizing?



Vacuum Metallizing is the way to big profits, exciting design, fabulous possibilities for the future. But—as with any relatively new process—it sometimes turns up "bugs" that have to be solved.

We've had our share. Because Bee's Logo Division produces a greater variety of coatings for vacuum metallizing, on more materials, for a greater range of end uses, than any other manufacturer.

We've had to come up with solutions to problems involving resinous base coatings used on plastics, metals or glass—each presenting specific production difficulties. Top coatings, clear, opaque or in color, are separate problems. Our answers involve coatings that bake or air dry in minutes, speeding production, increasing capacity, cutting costs.

The point is this: with Logo's variety of *standard* coatings for vacuum metallizing, applied as recommended, most production problems simply vanish. But to the tough ones, Bee's Logo Division brings you a great depth of technical service—the kind that gets problems solved.

Logo Vacuum Metallizing Coatings—and Logo services—can help you.

Here's a new booklet jam-packed with helpful information about vacuum metallizing coatings . . .

Send for it now. Contains complete coating chart for plastics, metals and glass.

A real working tool you will use frequently. Ask for Bulletin *D160*

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In a day of increasing cost, Vinsol resin still remains constant in price—one of the few things that can still be bought for five cents.

Here are the facts you'll want to know about Vinsol:

- a high-melting thermoplastic.
- saponifiable by alkali to form soaps.
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- dark colored, friable.
- substantially insoluble in aliphatic hydrocarbons.
- compatible with a wide range of resins and plasticizers.

Typical Properties

Melting Point (ring and ball)	112°C.
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Gasoline Insoluble	83%
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Available in lump, flake, pulverized, and emulsion forms—as well as powdered sodium soap—Vinsol is finding ever-increasing use in industry. Further technical data is available from Hercules.

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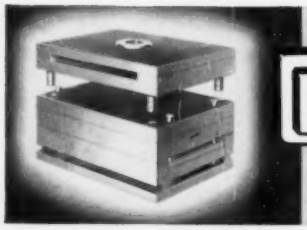

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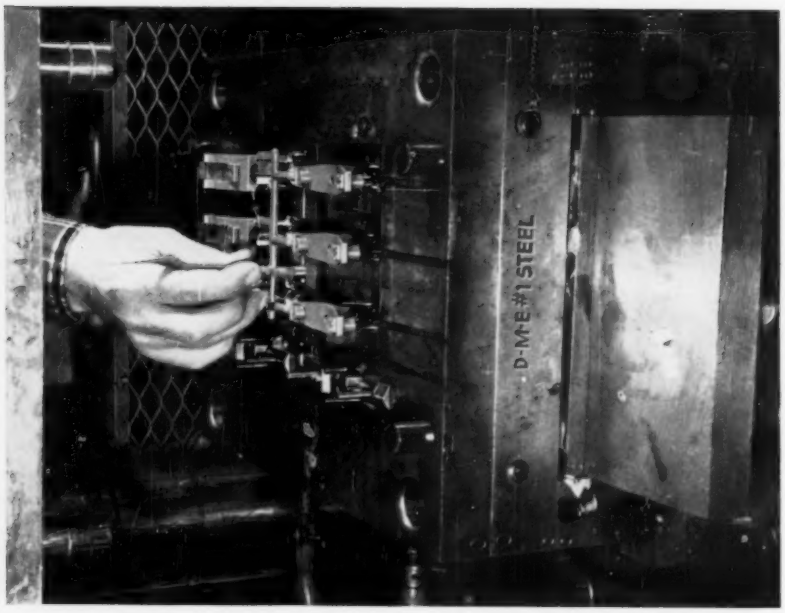

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Whether it's a one-cavity "test" mold or a 60-cavity high production run, chances are D-M-E has the right size Standard Mold Base to fit the job and the molding machine.

D-M-E's 32 standard sizes, up to 23¾" x 35½", with 100 standard cavity plate combinations for each size, give you the largest selection of carbon or alloy steel standards available from any single source.

Save on Design Time, Moldmaking Time, Replacement Parts and Delivery

Design time is reduced by using D-M-E's full-scale Master Layouts and Catalog of specifications and prices. Moldmaking time is reduced because all D-M-E plates are precision ground flat-and-square, ready for cavity layout and machining. Exclusive interchangeability gives you the added saving of immediate replacement of any component part. And D-M-E's seven branch offices and warehouses are always fully stocked with Standard Mold Bases and components to meet your delivery requirements.

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...With D-M-E's Line of Mold Polishing Supplies

Polishing mold cavities to a high lustre that is imparted to the molded piece was once "a well-guarded secret." But with D-M-E's complete line of mold polishing supplies moldmakers are able to attain the particular finish required by the part.

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59-A

Count on INVIN* 91 stabilizer to provide crystal clarity, lasting non-yellowing in vinyls

Count on 4 important stabilizing actions from INVIN 91 stabilizer, versatile liquid barium-cadmium stabilizer for clear, filled and colored vinyl stocks.

1. **Outstanding crystal clarity** — in calendered and extruded products.
2. **Unique inhibition of yellowing** — in processing, in service.
3. **Exceptional heat stability** — ample for modern high-heat, high-speed processing.
4. **Powerful light stabilizing action** — in severe outdoor and auto upholstery service.

INVIN 91 stabilizer aids formulating, too

Count on INVIN 91 stabilizer for two formulating benefits:

(1) Compatibility with *all* of the commonly used plasticizers – the organic ester types, the more sensitive phosphates, organic epoxides, ether esters, polyesters and hydrocarbons. Special plasticizer combinations, too, pose no serious problems.

(2) Wide choice of lubricants in addition to stearic acid . . . without regard to effect on heat stability.

Count also on minimum plate-out . . . even under difficult conditions.

National Lead Research has developed outstanding stabilizers that meet specialized problems in *all* vinyl stocks made today . . . such as high temperature service in electrical insulations; oxidation in outdoor products; color-changing impurities and temperatures in flooring; heat and light stability in plastisols, organosols. Each National Lead Company stabilizer simplifies processing, extends useful product life.

Ask us for suggested formulations and 4-page technical brochure on INVIN 91 stabilizer. Ask, too, for our comprehensive 12-page catalogue of vinyl stabilizers and gelling agents.

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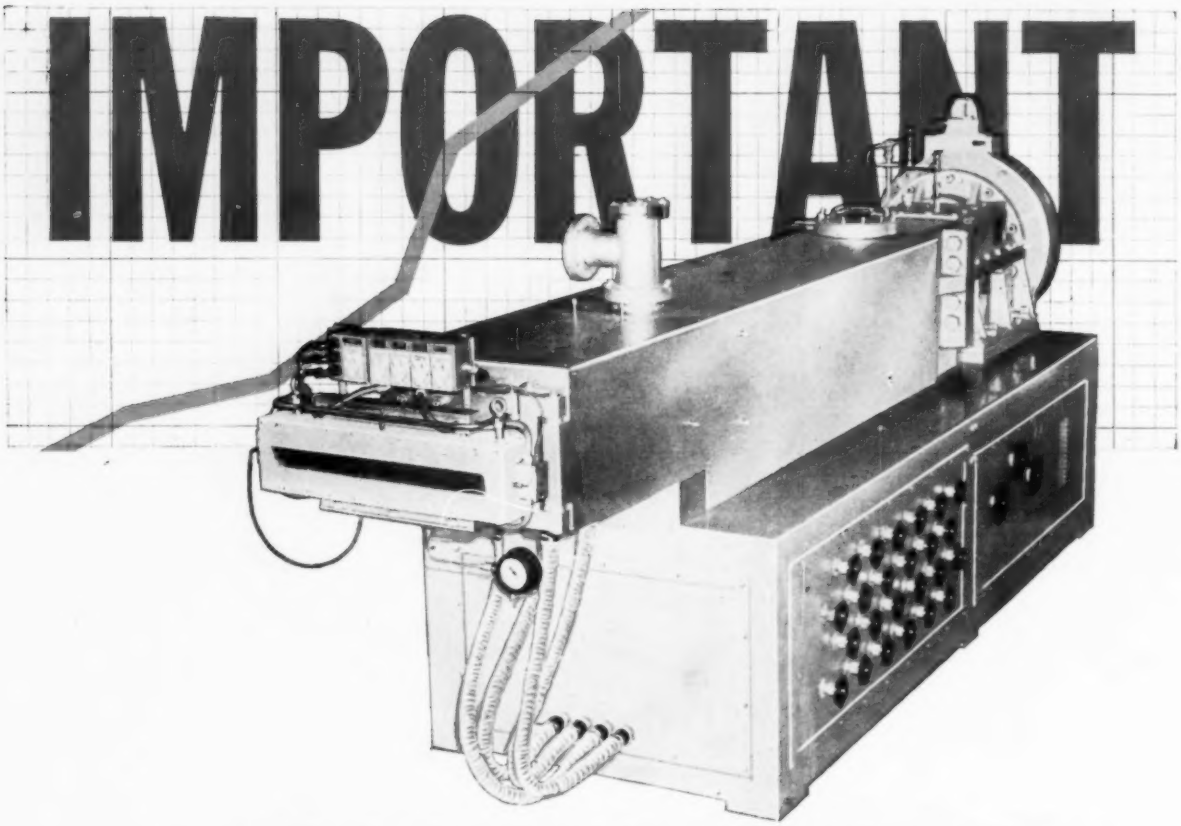
IMPORTANT



WELDING ENGINEERS COMPOUNDER-EXTRUDERS TURN IN HIGHER RATE RECORDS AND BETTER QUALITY QUOTAS WITH EACH NEW YEAR

There is a potent reason for this pattern of performance—the limitless combination of flight characteristics on the unique dual worms which work so efficiently for so many famous plastics manufacturers. None can deny the eagerness with which each WEI machine takes its place on these trademarked production lines. It has a right to be confidently proud for it is backed with the most comprehensive research experience and enthusiastic engineering team any production-planning executive could ask for in *his specialized equipment supplier*. It was built to produce more with greater speed and with such substantial power, space and labor savings that it can be the "fair-haired" friend of finance executives on every hand. We would appreciate an opportunity to prove the important dual worm advantages to you . . . to prove it in the laboratory . . . and on the production line where profits are made . . . not just promised.

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NORRISTOWN, PENNSYLVANIA

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MANUFACTURERS OF PROCESSING EQUIPMENT FOR THE CHEMICAL INDUSTRY

PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

The Outlook for 1960

In a series of specially written statements by ten industrial leaders, the plastics industry views and predicts its prospects for 1960.

L. J. FRANCISCO,
Gen'l. Mgr.
Plastics & Resins Div.,
American Cyanamid Co.
New York, N. Y.

(ALKYDS, MELAMINES, METHYLSTYRENES, POLYESTERS, UREAS)

SUBSTANTIAL advancement and improvement in the important qualities of melamine and urea molding compounds have been developed by the raw material manufacturers.

These factors, together with the aggressiveness of the molders, have led to a most healthy growth of the industry. And there is every indication that this growth will continue.

Improvements have been made by the raw material suppliers in pre-forming characteristics, contamination, color segregation, and other areas that have given the molders problems in the past.

At our molding compound plant, the number one order of every production day is to manufacture raw materials that are uniform in all characteristics. There is a continuing emphasis on meeting customers' needs and demands.

We know that we have not as yet reached the ultimate. And, we are aware also of the constant need for continuing improvement to meet the individual needs of the individual molders. The emphasis remains on these factors:

(1). To secure new equipment to produce more consistent, cleaner, readily-moldable compounds; better molding in odd shapes; and improved raw materials that are adaptable to automatic molding.

(2). To increase inventory consistent with increased demand, and to increase production capacity to meet customer demands for better delivery service.

(3). To search constantly for new equipment to have processes run more efficiently.

(4). To have more effective use of instrumentation to improve uniformity of product going to the customer by eliminating human error.

(5). To expand quality-control with more and better inspection techniques that strive for constant increase of the average quality level of outgoing material.

(6). To make increasingly rigid the systems of inspection in every stage of product manufacture to assure uniformity of quality control.

(7). To improve technology in production units to keep pace with the ever-growing demand for the product.

As for the aggressive development of the molders, the melamine dinnerware industry is a good case in point. Here, better design in shape for both beauty and

utility is coupled with improved technique of decoration. The dinnerware molder offers to the public a product that is break-resistant and, therefore, economical to use in the restaurant and home. It is a product that also combines the beauty and eye-appeal necessary to meet all dinnerware occasions. It is a product that has never been approached, much less equalled.

Although one industry is cited here for illustration, the custom molder, closure manufacturer, wiring device maker, and the button industry cannot be excluded when praiseworthy accomplishments are attributed to molders in their quests for continuing improved technology.

It is encouraging to see that the public's taste becomes more selective, better educated, and more sophisticated each year. In the long run, the buying public consistently supports good taste and sound design, thus encouraging molders to produce more unique products which reflect, both functionally and artistically, the exacting qualities of the industry. This holds true in the melamine dinnerware industry, as well as many others.

THE END

HARRY KREHBIEL, *Pres.*
Catalin Corp. of America
New York, New York

(MELAMINES, PHENOLICS, POLYAMIDES, POLYETHYLENES, POLYSTYRENES, UREAS)

IN predicting what kind of year the plastic industry will have in 1960, it would be best to look first at what happened during the past year. There is little doubt that the growth of the plastic field reached an all-time high during 1959, benefiting both suppliers and users of these man-made materials. It is estimated that when all figures are in, the use of raw plastics materials will have skyrocketed 25% over 1958. This applies to molding and extrusion compounds and to synthetic resins.

This phenomenal growth can be attributed to two basic facts: (1). the general increase in the use of these synthetic materials by consuming industries; and (2). the wider acceptance these materials are receiving from the consuming public.

Contributing to this has been the development of the field of packaging which is continually expanding as consumer goods manufacturers find a strong correlation between their sales and the excellence of their packages.

Important, too, has been the growth of synthetic resins, particularly the acrylics. Acrylic emulsions and solutions are widely used in the manufacture of such products as paints and other surface coatings, adhesives, floor polishes, pressure-sensitive tapes and labels, leather finishes, textiles, and paper coating. Use of acrylic resins in these applications provides properties which enhance the utility and salability of the final end product. Similar instances can be cited for other resins and other molding and extrusion compounds.

With justifiable optimism, we predict an even greater year for the plastic industry in 1960. Behind this are two important factors: growth in the scope of application of existing plastic materials and innovations in processing equipment such as blow molding; and the very nature of the plastics materials permits the continual development of modifications and alterations to improve specific properties, thereby providing a constant flow of improved products.

We predict the following new developments will find wider acceptance during 1960:

(1). A plastic cocoon of polyethylene film which permits construction work to continue without delay regardless of weather.

(2). More uses for nylon in molded heavy machinery parts, gears and bearings, houseware items, aerosol bottles, and anywhere that its unique properties of strength, resistance to heat, weather and chemicals, self-lubrication and other characteristics provides improved product serviceability.

(3). More and more custom-tailoring of polymers and copolymers.

(4). New inroads will be made in the field of industrial resins for treating, bonding, impregnating and coating natural products and synthetic materials.

THE END

E. W. WARD,
Dir. of Marketing
Celanese Plastics Co.
Newark, N. J.

(CELLULOSICS, POLYESTERS, POLYETHYLENES)

THE marketing breakthrough in blow-molded products was the highlight of the linear polyethylene industry for 1959. All indications point to an acceleration of the trend toward the use of blow-molded products during the coming year, notably in the container and toy fields.

During the year, most major manufacturers of liquid household detergents swung over wholly or in part from metal cans to linear polyethylene. It is anticipated that probably 80% of the 500-million units to be produced in 1960 will be made of linear polyethylene, and the figure may soon approach 100%. Only the limits on the capacity of the blow-molding industry will prevent even

faster growth. Eighteen months ago, production was negligible—virtually all such containers being cans.

The economics of plastic containers has long been recognized, but materials with the right combination of properties had been lacking. The stiffness of linear polyethylene, combined with its toughness, adaptability to blow-molding techniques, and colorability meet the requirements.

With the economic and performance tests passed in the field of liquid detergents, linear polyethylene producers now can look forward to increasing use of their product in containers for many additional items, including bleaches, waxes, cosmetics, and automobile specialties.

Manufacturers of dozens of types of toys, led by dolls, also are swinging over to blow-molded linear polyethylene or blends of linear and conventional, with economies of 50% and more sometimes resulting. Rapid growth is foreseen in this field, too.

After making modest inroads in a number of industries during the first year or so of its commercial life (the product first became commercially available early in 1957), linear polyethylene appears now to be entering a growth phase that will more than justify the early expectations of producers.

THE END

DR. A. E. SCHUBERT,
Genl. Mgr.
Chemical Materials Dept.
General Electric Co.
Pittsfield, Mass.

(ALKYDS, PHENOLICS, POLYCARBONATES, POLYESTERS)

THE plastics industry, notwithstanding recessions, continues to show strength as one of the significant growth areas in the American economy. For the period 1954-1958, major plastic raw materials exhibited a compounded growth rate in excess of 10% per year.

From their war-time role as substitutes, and given great impetus by research, development, and capital investment expenditures, plastics have become firmly embedded in industry as materials of fabrication and construction, many on a solid engineering and design basis.

As the price of metals and other conventional materials of construction continues to rise, that of plastics remains relatively constant or trends downward, thus increasing the value to the user. The consumer, in turn, has responded in his acceptance of plastics in a continually expanding spectrum of uses, which has resulted in an enlarging of the market base. To meet this burgeoning demand, molding and fabricating techniques are achieving a high degree of engineering precision, with improved equipment pointing the way to more efficient production capacities.

The exciting new class of polycarbonates represents a significant step in thermoplastics, offering a valuable combination of impact strength, heat resistance, and electrical and mechanical properties. Of great importance is the replacement of parts now assembled from several components. By redesign or molding the assembly directly, a polycarbonate molded part can offer improved performance and cost reductions in many cases. Many die-cast metal parts appear susceptible to replacement by polycarbonate resin. Introduced a scant two-and-a-half years ago, this new plastic has already been evaluated in hundreds of applications, many of which will be served by the output of a multimillion-pound-per-year plant scheduled to go on stream during the last half of 1960, supplanting current semi-works quantities.

The replacement of metal die-cast parts also is a trend in the use of phenolic plastics. Economic fabrication costs, coupled with the inherent value of phenolics, make this possible. The development of improved and faster-curing resins and molding powders will accelerate usage, not only in the replacement of metals, but in other applications as well, including bonding, impregnating, and laminating markets. The sixties should see a 5% per year total growth in this mature, but still expanding, segment of the plastics industry.

We and our associates look to 1960 and the years ahead with optimism in the growth of plastics. The next decade will outrival the 50's in the development of new materials and their acceptance by industry and the consumer.

THE END

E. E. WINNE, *Vice-Pres.*
Polymer Chemicals Div.
W. R. Grace & Co.
Clifton, N. J.

(VINYLS)

HIGH-DENSITY polyethylene now is beginning to live up to the original expectations and promises that seemed likely at the time of the break-through to this new plastic about four years ago. Industry observers have stated repeatedly that high-density polyethylene is already far outpacing the growth of low-density or conventional polyethylene and other plastics. It is expected that 1959 will see the consumption of 80-million and

possibly 90-million pounds, only three years after this material became commercially available. It took 10 years for low-density polyethylene to reach this level of use.

One of the most interesting observations about high-density polyethylene is that it opens the way to new or improved products never before possible. High-density polyethylene is presently being used in four main categories: housewares; toys; appliances, automobiles, and industrial components; and blown containers, most notably for use with household detergents.

The near-term market for detergent containers made from high-density polyethylene is estimated at about 400-million containers annually, consuming about 40-million pounds of high-density polyethylene each year. Only plastic films are used more widely in all kinds of packaging. It seems likely that this new use of high-density polyethylene for packaging detergents could be the key that turns the lock to open up the entire area for packaging household chemicals, bleaches, disinfectants, ammonia, and waxes, to mention only a few such products. This kind of packaging could foreseeably consume hundreds of millions of pounds of high-density polyethylene annually—possibly as much or more than the present plastics industry capacity for this new plastic material of about 300-million pounds per year.

Many housewares manufacturers are switching to high-density polyethylene for a wide variety of items. Other manufacturers are contemplating switching to high-density for a large majority of their products. High-density polyethylene also is being used increasingly for toys.

High-density polyethylene has already moved into its role for use in such components as the housings for power lawn mowers and parts for television sets, as well as parts for floor washers and vacuum cleaners. In 1960, automobiles make use of high-density polyethylene for heater ducts, seat shields, glove compartments, and windshield tanks. Flame-retardant compounds of high-density polyethylene are expected to make considerable inroads on thermoset plastics for television use, appliance components and automotive applications. Here, for the first time, is a readily moldable, rigid, flame retardant, economical material.

Expanded use of high-density polyethylene is imminent in a number of fields, and new fields of application are about to open. The toughness and durability properties of high-density polyethylene make it the ideal material for use in large injection casting and parts that have weights in excess of three pounds. Such moldings should be widely used for carrying cases and tote boxes. Development of filling and sealing equipment will see high-density polyethylene move into a prominent position as thermoformed packages.

High-density polyethylene as film for packaging appears to have good possibilities. An intermediate-density resin is particularly suited for overwrap applications, as well as many other packaging uses for polyethylene film bags. Film made from this compound has a number of advantages compared with film from lower-density polyethylene resins. These advantages include more stiffness for better handling on automatic equipment, and improved barrier properties over lower-density films. Clarity of this intermediate-density film is good, and high rates of production (in gages down to less than one mil) can be attained in film extrusion from this resin. Compared with cellophane, film made from the resin combines the advantages of improved shelf life for long-term moisture protection and a protective cover against soiling. This intermediate-density polyethylene resin also is considerably less expensive than cellophane.

Production of stronger, more chemically-resistant polyethylene pipe is possible through the use of high-density resins. Pipe made from this material is able to withstand 600 psi. fiber stress, compared to only 385 psi. for low-density and 510 psi. for medium-density pipe.

Expansion of established uses and new applications coming up point the way for an estimated 160-million pounds of use for high-density polyethylene in 1960.

THE END

J. D. MAHONEY,
Dir. of Marketing
Mobay Chemical Co.
Pittsburgh, Pa.

(POLYURETHANES, POLYCARBONATES)

THERE are many yardsticks for measuring the growth and stature of an industry. The breadth and scope of products and services it offers its customers are the more reliable gages. In this sense, it is doubtful whether any other field of manufacture can come close to matching the record of the American plastics industry in terms of products and progress it has generated in the past quarter of a century.

Surely, no other industry can boast of an equal list of raw material products, the range of properties these materials possess, and the fantastic diversity of functional uses to which these materials are put.

With almost perennial regularity, new types of plastics have been introduced to broaden the base and widen the range of influence these materials have earned among product designers, industrial engineers, manufacturers, merchandisers, and consumers. Each of these materials has had its day in the spotlight glare of introductory publicity, has gone on to become established and accepted in its markets, and has become firmly bonded into the constantly-expanding structure of the industry which first created it and now continues to nourish its further growth and development.

We have watched this business phenomenon take place in the polyurethane field during the past few years. From a shaky, stumbling start five years ago when total poundage figures were more of an apology than a busi-

ness statistic, today more than two dozen major material manufacturers have their sights firmly locked on a 100-million-pound market for 1960. This will be an increase of roughly 50% over 1959, and 150% over 1958. Much of the increase will be hooked to new markets for urethane flexible and rigid foams, elastomers, and industrial coatings.

We have found that the key factor behind this market growth is our never-ending search for "the competitive edge" over other products. This is where the emphasis has to be placed in any marketing job today, even to gain a foothold. And the job gets tougher each step of the way. Competition is a stern master and exacts a full measure of effort for every inch of ground it surrenders. And the responsibility for holding what you have never relaxes.

This is the way it has been for all plastics from the days of the celluloid collar down to the present. Yet, the remarkable thing about this system is that it does not appear to settle into a contest of survival for older products, so much as it results in an incentive to invent new ones.

For example, we predict that the polycarbonates will take the stage in 1960 as the bright new star in the thermoplastics galaxy. Polycarbonates have been a long time coming, one reason being that their development has been an exceedingly complex assignment.

The simple creation of a new thermoplastic having properties comparable to its predecessors would not have been such a difficult task at our present state of technology. But to create a thermoplastic which, in one material, embraces all of the critical engineering properties found singly in only a handful of other materials—and to weld those properties together near the ultimate specification level—this is the only kind of achievement worthy of the name "progress."

We are confident it has been done. While a great deal of application development work remains to be completed before this material can earn its rightful place in the open, competitive market, the history of the plastics industry itself is our greatest source of assurance that this job also will be done.

In coming months, plastics engineers, manufacturers, and their customers will hear and read a great deal more about this newcomer, Merlon. Before 1960 ends, we predict that Merlon will have become one of the strongest links ever welded into the chain of plastic materials which will one day close the ring on the remaining unsolved problems of material specification in industry.

Chemistry will some day yield the secret formula for the ultimate material, sought by man down through the ages. This goal will be gained as all worthwhile goals must be gained; sometimes by groping, plodding steps, and sometimes by spectacular, dramatic discoveries. But, as long as the search goes on, the attainment of this goal is a certainty. All that takes place in the interval is called "progress."

Polycarbonates are the latest tangible evidence we have to assure us that this ultimate goal has been moved one step closer to realization, just as all of the other new materials were steps forward in the same direction.

The business man—be he engineer, manufacturer, or end-user—who looks upon a new material in this context, and gears his thoughts and actions to what it means, is the one who stands to profit most from the work accomplished.

Someone once said that all of the progress in the world is generated by those who are dissatisfied with things as they are. The company or industry that knows how to turn that discontentment into a creative productive force, need never fear a look into the future.

THE END

GEORGE WASH, *Director Plastics Sales Division, Phillips Chemical Co. Bartlesville, Okla.*

(POLYETHYLENES, POLYPROPYLENES)

WE anticipate in 1960 continued substantial increase in industry-wide sales of linear polyethylene—already recognized as the fastest growing plastic. The greatest upsurge will be in the newer use area of blow molding, film and sheet, and pipe and conduit resins. We expect sales of the companies' linear polyethylene resins in these fields to at least double in 1960 over 1959, reflecting industry trends.

Recent development of new polyethylene copolymers, and tailored resins which greatly extend the range of useages for linear polyethylene, is a prime reason for my optimism. For example, note the recent nationwide introduction of liquid detergent packaged in bottles made of this plastic. A tremendous market in itself, it also opens up new possibilities in packaging of other large-volume household products, such as bleach, wax, and liquid starch. New tailored resins also have been introduced in the promising fields of merchant pipe, conduit and wire and cable coating. These resins have exceptionally high resistance to environmental stress-cracking.

Phillips also is "bullish" in the fields of clear overwrap film and heavy-duty industrial film. In the vast field of clear overwrap film, two important developments should be cited. One is the recent commercial availability of linear polyethylene film of exceptional sparkle, clarity, and shelf-life. The other is the recently displayed high speed, low-cost sealing device for this film developed by our engineers. The market in the heavy-duty industrial film field also will grow substantially in 1960, because of a new tailored resin.

Broadened, large-volume use of this plastic in already established fields is a further important reason for its expected 1960 growth. Injection molded and thermoformed industrial and automotive parts, housewares, hardware and other consumer items.

THE END

H. R. REICHHOLD,
Pres. & Gen. Mgr.
Reichhold Chemicals, Inc.
White Plains, N. Y.

(ALKYDS, EPOXIES, MELAMINES, PHENOLICS, POLYURETHANES, VINYLS)

THE chemical industry can attain record annual sales of $30-billion in the next few years if it will not sit back and rely on current production, but step up the building of new plants to meet the growing demand for more plastics.

This would rank it third among the leading manufacturing industries in the U.S., up from its present fifth position. Only food and allied products, with sales of $51-billion, and transportation equipment, with sales of $36-billion, would be higher.

To attain this position, we as an industry must not hold back construction of new plants due to fear of over-production. The future of the industry rests on its ability to keep pace with the increased demand brought about by the development of wider uses of plastics.

The volume of plastics produced and consumed in 1959 rose 30% above 1958. This is certainly proof that the demand for plastics is growing, and will continue to grow at a healthy, steady rate.

This significant growth has been made primarily in phenolics, ureas, melamines, styrenes, vinyl, polyesters, and polyethylenes. It is noteworthy that the highest growth in terms of percentage and poundage increases has been in the comparatively low-priced materials.

This is the Age of Plastics, so that by reducing the price and thereby bringing about a higher volume of use, the industry can increase its over-all profits.

There are many additional ways that increased volume of use can be brought about. One is to develop new programs for informing engineers, architects, and builders of the inherent possibilities of new plastics in the construction of homes, schools, office buildings, and factories. This group should be informed of the simplicity and adaptability of using plastics in building. The success of such a program would see the use of polyesters, epoxies, styrenes, phenolics, and other plastics reach new highs in consumption. In doing this, it is important to keep in mind that efforts must be made in order to bring about much-needed modifications of old and outmoded building codes still existing in this country.

Increased use of plastics by foreign countries is another area where the industry can expand. This would serve to create added demand for such basic materials used in plastics as maleic and phthalic anhydrides, formaldehyde, and phenol.

In convincing these countries of the vast advantages of plastics over other materials, the fact that only simple molding equipment and basic materials are required in their production should be pointed out. Too, that this eliminates the need for costly construction of steel or concrete plants, is of great importance.

Increased shipment of prefab houses to help solve the need for low-cost housing, can help bring about a greater interest in plastics in foreign countries. Of particular interest to the U.S. would be such areas as India and some of the Near East countries.

The successful growth of the chemical industry rests on confidence in the future. At Reichhold, we will continue to expand production of plastics, and construction of new plants to produce them to keep pace with this growth.

THE END

D. P. JONES, *Sales Mgr.*
Plastics & Resins Division
Shell Chemical Corp.
New York, N. Y.

(EPOXIES)

1960 should prove to be both a challenging and rewarding year for the plastics industry. While increasing competition is likely to be felt in many phases of the industry, the technological developments arising from the fight for leadership will undoubtedly lead to broader uses of plastic products. The outlook is particularly promising in the epoxy resin field. In the following paragraphs, I will review a number of the recent developments and offer some indications of their importance.

The electrical industry is one of the most promising fields for broader application of epoxy resins. While the outstanding properties of epoxy insulating compounds have been known for many years, suitable equipment for applying such compositions on a production-line basis has only recently become available commercially. Another recent advance has been the discovery of low-cost modifiers for epoxy resins. As a result of these developments, epoxy resins now can be used economically in many electrical applications where they previously had been considered too costly.

Considerable progress also has been made in the development of epoxy resin-based compositions for highway applications. The most significant advance in this field has been the development of resinous paving cements and resin-based compositions for sealing, resurfacing and skid-proofing bridge and highway surfaces. Other highway maintenance problems are being solved with epoxy resin-based pot-hole patching compounds and bonding agents.

The technology developed in the highway resurfacing field has stimulated the use of epoxy resins in industrial floor-surfacing applications. Here, epoxy resin-based compositions are proving to be an economical means of preventing concrete erosion, and of resurfacing areas which have already been damaged. In extensively damaged areas, the floor is built up and leveled by using an epoxy adhesive to bond new concrete to the old. Smaller areas can be repaired economically by simply filling with a sand or aggregate-filled epoxy resin composition. To protect new or repaired concrete flooring areas from acids, cleaning agents, and other corrosive materials, a tough, chemical-resistant wearing course based on epoxy resins is applied by rolling or troweling. Non-skid properties are imparted to the wearing course simply by adding sand or other abrasive to the formulation.

Glass reinforced-epoxy resin pipe, tanks, sheets, and special shapes should also find much wider acceptance during 1960. Such products are rapidly proving their value in applications where a combination of corrosion resistance, heat resistance, and high strength-to-weight ratio is needed. Continued growth also is expected in such established applications as plastic tooling, electrical and structural laminates, adhesives, and protective coatings.

New curing agents, flexibilizers, and low-cost modifiers also contribute to the optimistic outlook for 1960. A flexibilizing epoxy resin, should permit the use of epoxy resins in many cases where these resins previously had been considered too rigid. With the proper selection of curing agent and base resin, up to 100% elongation can be obtained.

The curing agent permits the use of conventional spray equipment to apply solvent-free epoxy resin coatings which cure at room temperature. The long sought-for combination of long pot-life and room temperature cure is made possible by this unique curing agent, which has a very low order of reactivity until triggered by atmospheric moisture (or heat).

A heavy, compatible petroleum fraction is useful as a low-cost modifier for epoxy resins. Although not yet evaluated in potting and casting applications, it has been found to have several advantages in coating applications.

The above-mentioned developments alone justify an optimistic outlook for 1960. However, this is not the complete story. Because of the unusual versatility of epoxy resins, it is reasonable to expect other new uses to be discovered during the coming year.

THE END

J. D. BENEDITO,
Vice-Pres.—Sales
Union Carbide Plastics Co.
Division of
Union Carbide Corp.
New York, N. Y.

(EPOXIES, FLUOROCARBONS, PHENOLICS, POLYETHYLENES, POLYSTYRENES, VINYLS)

WE can bring 1960 into focus by looking at the plastics industry's strengths and weaknesses. Ours is one of the most dynamic industries of the twentieth century. We have become accustomed to seeing each year's production outstrip the preceding year; in 1959, we were 20% ahead of a record 1958. In 1960, we expect a healthy 15% increase to a total plastics output of more than 6.25-billion pounds.

On the other hand, the segment of the industry that has led this growth for the past several years is in a dilemma of booming business and poor profits. I refer to the flexible film field which, ironically, represents one of the outstanding market development programs of our time. In 1959, the industry showed a net increase in polyethylene film production of more than 75,000,000 pounds. Yet much of the film field was under heavy price pressure throughout the year and, extruders in particular, had rough going.

This seeming contradiction, I am convinced, can be traced to the fact that market development has not kept pace with the vast increases in production capacity. Today's high production results from sound market development conducted five- and six-years ago. The recent low profits are the effects of a market development de-emphasis which has occurred since then—a de-emphasis which will, unless corrected, lower profits still further in the years ahead.

If we are to remain a dynamic industry, we must invest in market development as willingly as we invest in new plant capacity. It requires patient dollars, but the returns can be extraordinarily high.

We must therefore measure the success of 1960 in terms of our willingness as an industry to bring market development and plant capacity back into proper balance.

THE END

Jacob A. Kempf was born in Chicago, Ill., in 1910, and graduated from DePaul University in 1932. Entering the plastics industry, he was associated with Chicago Molded Products Corp. from 1935-1942, and with Amos Molded Plastics from 1942-1945. After working as a sales representative from 1945-1954, he joined Bull Dog Electric and has been with that company until the present, and is now Head of the Plastics Division. He also is active in SPE and various fraternal organizations. Mr. & Mrs. Kempf have two children (both boys), and make their home in Urbana, Ohio.

Automatic Plunger Molding

What a molder had done to plunger-mold thermoset materials competitively in a self-contained molding plant which is automatic in all respects.

J. A. KEMPF, *Head of Plastics Division, Bull Dog Electric Products Co. of Ohio, Div. of ITE Circuit Breaker Co. Urbana, Ohio*

THE purpose of this article is not to cross swords with the custom molders, materials suppliers, and equipment or press manufacturers, but to describe the approach, reasoning, solution, and practicality of a concept in plastics manufacturing that can possibly be the re-awakening force for our industry, providing the spark that will give a new life to the thermosetting molding field whether it be custom or captive in operational scope.

Approximately four years ago, we approached the problem of initiating a molding operation that ultimately would be a fully self-contained automatic molding plant. Automatic, from material handling, to shipment of finished sub-assembly parts to the various manufacturing units engaged in completion of our company's product. Naturally, the problem involved the production of a wide range of molded parts produced from a wide variety of molding materials, including long run (large volume), as well as short-order requirements. Quantities ranged from 1,000 to 1,000,000 or more parts.

Many of the parts were typical compression molded shapes, and the problem in this instance resolved itself into a selection of equipment which was adequate and economical for our needs, both present and future. Other items were of a design that could be practical only if they were produced by plunger or transfer molding methods. Automatic compression molding machines already were available; however, we could not locate a press maker who was manufacturing equipment of the type desired for our plunger molding needs. Research in the industry disclosed that two manufacturing plants had to have equipment especially built for them in order to handle specific job requirements. Our problem also involved the development of a press design to complement our proposed plant design and operation.

Planning the Operation

Our first step was to define our current requirements as closely as we could, and anticipate our future development and expansion as far into the future as possible. These factors were transposed into terms of equipment suitable for our needs. Consultation with material suppliers, equipment makers, and press manufacturers, supplemented by our previous experiences and knowledge of plastic molding and engineering requirements and limitations, aided us in our conclusion.

The variety of parts involved, plus their weight and size differentials, clearly indicated that our molding press would have to accept a wide range of material volume changes, multiple cavity arrangements, and a variety of molds.

Molding Press

A maximum of 16 ounces of a material was selected as a starting point. This we calculated would require 150 tons of clamping force. This clamping tonnage would permit us to use a maximum of 30 tons of plunger pressure, adequate for transfer of molding material with minimum danger of gaping, bridging, or flashing of our molds. In order to give us maximum flexibility for die mounting, the press would need mounting platens of at least 24- by 20-inches. We determined, also, that a press having 38- or 40-inches of daylight opening, with 18- to 20-inches of stroke, would cover our range of molding requirements.

The transfer stroke was determined after lay-out of a psuedo mold, complete in all details with respect to ejectors, cavity depth, and plunger heights, and set at 12-inches. We now had a clear picture of a self-contained, double-ram molding press; the equivalent of which was, and is available from a variety of press manufacturers. We could now proceed to mechanize. Figure 1 shows the complete production assembly using the Rodgers 150-ton full Automatic Transfer molding press.

Materials Handling

Material handling had to be considered. Preheating of the material was necessary to operate our machine at full tonnage capacity, and to ensure quality and quantity of out-put from the mold. To preheat 16 ounces of material in adequate cycle time (60 seconds maximum), a two-kilowatt machine was selected as sufficient. Material in granular form presented the following difficulties: (1). Waste due to spillage and dust; (2). The volume control of each change; (3). The space required to handle a column or tray of loose granules; and (4). The conveyance of the material to the preheater and then into the well of the mold.

It was concluded that preforms would add slightly to cost, but not enough to offset the problems mentioned above. Preforms of proper density and controlled weight, diameter, and thickness could be bulk loaded, mechanically conveyed to position, re-positioned as required, and finally moved into the mold area. In addition, preforms would drop into the well of the open mold. The method of feeding preforms to the mold had a two-fold effect, both on the press design, and on the molds.

Inasmuch as we planned to use gravity to position the preforms in our mold, we elected to operate a downward-acting press with an up-acting transfer ram. Thus, the mold is open during the preform feeding, and must be closed and clamped before the up-acting transfer stroke commences. We had chosen a 12-inch plunger stroke, and the lower mold height was set at 10 inches. This provided a maximum of two inches for the stripping or clean-out stroke which would be essential if we were to keep the transfer plunger from

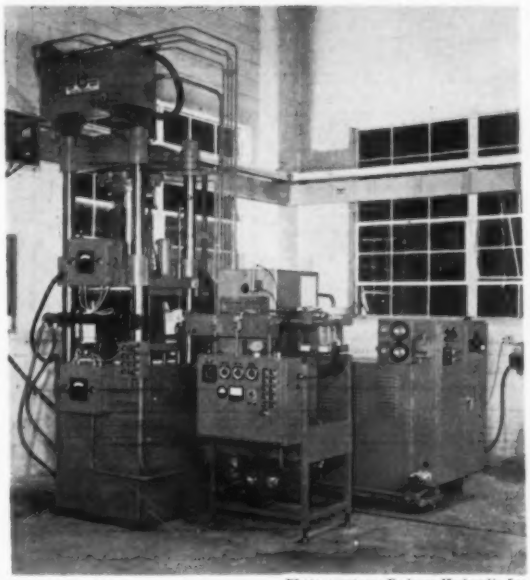

Photo courtesy: Rodgers Hydraulic Inc.

Fig. 1. Complete production assembly of Rodgers 150-ton full automatic transfer molding press.

sticking after repeated cycles. The high-frequency preheater would need to be stationary for operational and maintenance reasons, and its accompanying hopper and the preform feed arrangements would be best held at a constant level. The height of the lower half of the mold was stabilized at 10 inches.

Up to this point, we have (1). A downward-acting press with an up-acting force or plunger; (2). A high-

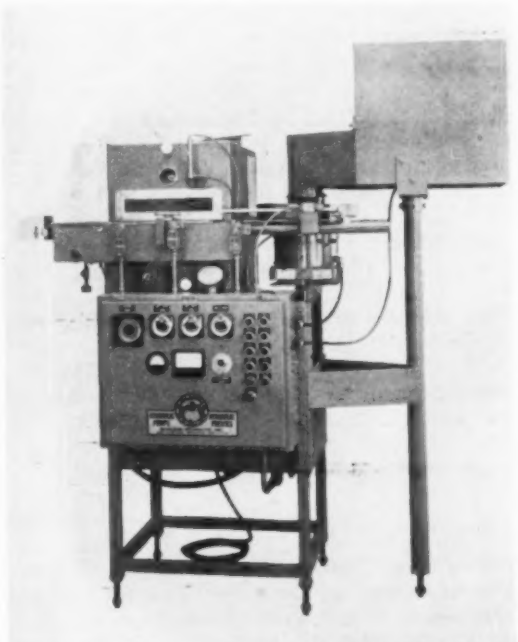

Photo courtesy: Rodgers Hydraulic Inc.

Fig. 2. Automatic transfer press with hopper loader and preheater feed assembly.

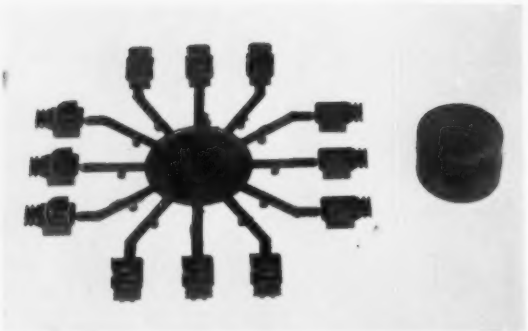

Fig. 3. Preforms (right) and full molded shot of caps for circuit breaker bodies.

frequency preheater; and (3). A preform loader, positioner, and feeder. We can open and close a mold with the press, and force material into the mold cavities through runner and gates provided in the mold. The press with preheater feed assembly unit and hopper loader is shown in Figure 2.

Ejection of Molded Parts

With two opposed cylinders, the problem of molded part ejection was simplified. We could use either top or bottom ejection or both, should we so desire. The lower cylinder was faster operating, and had 12 inches of travel (we had calculated a maximum of 10-inch ejector travel), and the low ram was selected accordingly.

To be assured of sufficient ejection force, two pullback cylinders were added to the press, and linked to the return side of the lower cylinder. The molds we are using are of top-ejection type, although provisions are provided for bottom ejection. The ejector bars and parallels are permanent parts of the mold set.

The lower cylinder return stroke, coupled with the pullback cylinders, pulls the press ejector-bar down, thus moving the mold ejector bars and pins, and pushing the pieces from the mold forces. A sliding pan or tray was provided to catch the ejected molded parts and remove them from the mold.

The press was self-contained as to hydraulic, air, and electrical circuits. We did not have steam-power available, so it was natural to add the electrical heater circuits and thermostat controls to the press proper. The mold was provided with its own heating platens into which cartridge heaters could be inserted. This permitted insulation of the press platens, and also eliminated the need for mounting grids to the press. With this set-up, each mold becomes a self-contained unit. With all of the parts lined up, we now could develop a cycle that would be repetitive.

Molding Operations

Based on more than three years of production operation experience, we came up with the following description of the operational sequence necessary for automatic plunger or transfer molding. The press controls are arranged for manual, semi-manual, or automatic operation, (either plunger or compression) selection. Selectors for top or bottom ejector operation also are provided.

We will concern ourselves with top-ejection automatic operation only. The mold set-up consists of positioning a mold over the lower ram, automatically centering and positioning the mold. Molds are secured to the top press platen by four lugs and bolts, and to the bottom platen by eight bolts and lugs (due to the extra force that may be exerted during the stripping action of the lower ram). The cartridge heaters are placed into the mold, and are plugged into control boxes. The temperature is set on the controller, and the mold brought to temperature.

The molds' knock-out bars are fastened to the press knock-out bar. After the mold is at proper temperature, it is opened for clean out and removal of mold-surface preservatives. In the meantime, the proper preformed material is placed in the feed hopper and the high-frequency preheater circuit is turned on for check-out, adjustment, and warm-up of the feed mechanism (one to six preforms). We initiate production here with a dry run or a cycle without actual molding of the material. The press has been on manual control through mold set-up time and is now set over for automatic cycling. Push buttons actuate the relay, initiating the down- or closing-stroke of the top cylinder. This contactor also actuates the positioner, placing the preforms into the high-frequency preheater.

The press closes and builds up to clamping tonnage, which is maintained through the cycle. As soon as the proper clamp tonnage is reached, the lower plunger is activated to begin the movement of material (none is present at this time) into the mold cavities. At the same time, the preform positioner returns for the next load of preforms. The upward-action of the lower cylinder also actuates the press cycle timer (previously adjusted for proper cure cycle).Tonnage on the lower cylinder is preset, and is maintained by a time controller set to ensure full transfer of material. After this time elapse, the pressure is released allowing the system to circulate the oil for cooling. At the same time, the cure or cycle timer is actuated (by the relay for the up-action of the lower ram), and a timing delay cycle is initiated on the high-frequency preheating unit. When this is completed, it will begin the preheat timer that activates the preheater unit to provide heat to the positioned preforms.

Upon completion of the cure cycle, the press opens. When fully open, a tray or pan is positioned mechanically over the lower half of the mold. The lower ram advances to the top limit of its stroke, initiates an air blast (for preliminary flash removal), and then returns to bottom position. This return also pulls the ejectors downward, and pushes the mold runners and cull from the mold force on the top half of the mold. The lower ram again advances for the clean-out or stripping stroke. This permits the ejectors to retract, provides a stripping or clean-out stroke, and insures positive removal or ejection of the molded parts (see Figure 3).

When the lower plunger reaches the top limit this second time, it again begins to return to bottom position. At the same time, the tray which now carries the molded parts, moves out of the press area to the unloading position accompanied by a final air blast to

(*Continued on page 44*)

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I'm a Yankee Doodle Dandy

THIS title might seem flippant in view of the sober reflections that follow. But I honestly could not think of a better capsule comment that sums up my feelings after recently surveying European operations and developments.

The purpose of my trip was to evaluate: (1). The latest developments in blown extrusion and injection molding machines; (2). Personnel; and (3). Sources of supply for molds and also finished items in my client's particular field (their items are poorly protected importwise and are susceptible to both Oriental and European price pressures.)

With respect to the machinery, it would appear that in the two fields of injection molding and blow-molding extrusion, European developments have taken the lead from the United States, especially so with two different German types in the smaller size (60 grams or less) with pre-plasticized injection molding worked by a screw feed.

The Italian machines lead in the heavy-shot class with pieces of 15 pounds that come out beautifully, with high-gloss finish, etc. The improved performance of the six turret-type was a factor to be considered, especially in view of the simplified mold design to which this lends itself.

The biggest surprise to me was the advances made by Swiss machine manufacturers who are really worrying their Italian and German counterparts. I was particularly impressed by their multi-head (four) blown extruder, which is a good answer for the manufacturer plagued by narrow-width, low-profit tubing. Incidentally, I heard complaints from European machine shops that the Swiss were successfully raiding them for key help by means of the usual attraction; i.e., money.

Advances in other fields surpassed U.S. developments and were recognized as such by others in the party. However, I will not detail them in this article, but confine myself to the ones about which I have personal knowledge.

The advanced European technology and research gave me a feeling of uneasiness and pessimism, and I suspect that our machine builders have again fallen into the rut of complacency and resigned themselves to following European developments instead of leading the way. Even the Europeans admitted that the United States had been far out in front of them, and they feel that they have accomplished quite a feat in taking the lead from us.

In our quest for sources of supply for molds, finished items, etc., I had the opportunity to view operations in detail. In brief, this is my evaluation.

Long-range planning (as we know it) is much rarer than in the United States. In its stead, there has reappeared, more or less in the open (depending on the product and the circumstances), the cartel arrangement or "mutual understanding" to consolidate market territories and primary price structures.

Even though many "new" faces are on the industrial scene today due to the upheavings of the war and post-war era, their thinking goes back to the pre-war feeling once they are successful. There is little middle-management training. The top echelon sits tightly in the saddle, and does not encourage thoughts of advancement by outsiders. They do encourage (nay, "demand") contributions of technological advances from those outside the ownership or top-echelon bracket, but with the flat proviso that one cannot move up into that sacred circle.

Unquestionably, their educational program is much more thorough than ours. Their apprenticeship makes ours pale in comparison, but one of the real reasons for their success is the nature of the people themselves. How many American sons of turret-lathe operators or mold makers wish to emulate their fathers and follow in his craft? Or, for that matter, how many fathers want their sons to follow them in their trade? We want our sons to do better than us.

At this point, I would like to pass on a provocative analysis that was made by a European in a discussion we had concerning the differences between our way of life and theirs. When I asked how the average European can live with the high prices there, he pointed out that they have a distrust of their money and put it into material things: appliances, clothes, home furnishings, etc. They do not try to put their money in the bank or invest it in stocks and bonds as we do here in America. It was pointed out that they have a greater sense of security in Europe as regards sickness and unemployment. They pay for this indirectly; i.e., in Italy when a worker gets paid $1.00 per day, actually the cost to the employer is $1.80. The 80% that goes to the government is presumably for these insurances.

Consequently, the European worker does not need to save as we do in America. It was pointed out by us that in America we, too, have these programs, but this was refuted by the contention that our program was not as embracing or proportionately ratioed as theirs is, and that where it is, it was confined to only a small segment of the working force (or as he referred to it, "your aristocracy of labor"). He then went on to say, "Perhaps you Americans have such a sense of economic insecurity, that you try to have your children advance economically ahead of their parents so that they (the parents) can look to their children for security against adversity."

There also is something new taking place in Europe today which is actually a leaf from our book. In their rush for production, they too have turned to the so-called "specialty" or production-line technique of confining a worker to an individual operation, thereby shortcutting their usually intensive all-around training. When the need for well-rounded machine shop help comes up, they too will feel the pinch.

As to their general ability, I do not believe they are any better than our American worker. We still can teach them a lot of tricks. Frankly speaking, we are importing from them their cheap labor (primarily with regard to finished consumer products, molds, machine parts, etc.), but not finer workmanship.

Perhaps this explains why they are ahead of us in technological development. Due to their protected price policy and cheaper labor costs, they can pour more money proportionately into development than we in the United States, with our free competitive markets, can do.

I observed working conditions which were pretty hard to take. Despite the many shortcomings, as compared to United States standards, I was particularly impressed by the youthfulness of the personnel in the factories and, in most cases, by the cheerfulness and bustle that were evident.

My biggest shock was seeing plants in West Germany that were loaded with East German machinery. When I inquired as to whether they were better than those from West Germany, the answer was, "This machine would cost the equivalent of $17,000 in West Germany, but only $12,000 from 'there'."

The impression I left with was that there were many new faces in European industry, but its the same old clique. The benefits are not going to the people, but instead going to those who have succeeded the "rich aristocrats" (they now are referred to as the "rich industrialists"). The people still jump at the end of the month, and can just squeeze through until the paycheck comes.

—THE END

Automatic Plunger Molder
(Cont'd. from page 42)

remove any remaining flash, culls, runners or parts from the mold-area surfaces. This blast of air covers both top and bottom halves of the mold. During this time, the high-frequency preheater has performed its cycle. The preforms now are ready to move into the mold, and are mechanically advanced from the preheater to the well in the mold. The feed mechanism retracts, and its full retraction actuates the relay to close the press and repeat the cycle, thus providing continuous automatic cycling through a combination of air, hydraulic, and electrical circuits.

Provisions are necessary for maintaining interlocking and sequencing of all phases of the operation, eliminating potential damage to equipment or molds.

We now have achieved our end, a repetitive mechanical cycle combining mold, press, and preheater. One more important detail must be mentioned—the mold, its design, and construction. The following basic concepts should be included in all molds for automatic operation:

The cavities, plunger, and their yokes, when employed, should be mounted upon hardened back-up plates. The heating plates are now a basic part of the mold. Mold parallels replace the old-type press grids, and are permanent mold-set parts. Each mold has its individual material well. The ejector bar and its pins also are permanent mold parts. Positive return and positioning of these ejectors are a part of the mold set.

Spring-loaded, push-up pins should be provided in the cavity section wherever possible, together with positive-return pins for their return. The mold runners and culls must be designed so as to remain on the ejector side of the mold. The area around the mold cavities, runners, and culls must be relieved to reduce as far as possible the area upon which the clamping force is to be exerted, thus assuring maximum holding pressure against the opposing plunger pressure during the molding cycle. Side cores, cams, etc., can be added as in conventional mold design practices.

Economics

You can now visualize the feasibility and practicality of this type of equipment and operation. The econom-

(Continued on page 57)

A. W. BYXBEE, *Gen. Mgr.*
Pacific Coast Division,
Raybestos-Manhattan, Inc.
Paramount, Calif.

How Teflon Improves Surgeons' Heart-Lung Machine

A step-by-step explanation of the machine with Teflon parts, and its use in critical heart surgery.

AMERICAN medical science now is using tough, reliable Teflon to save human lives in the operation of its mechanical marvel, the heart-lung machine (see Figure 1).

In the first such application of Teflon, tetrafluoroethylene resin, surgeons at the University of Colorado Medical Center, Denver, are using the plastic material to perform three vital functions in their machine. Teflon also has replaced stainless-steel parts and silver solder in jointed connector areas, and is used in more than 40 separate locations in this application.

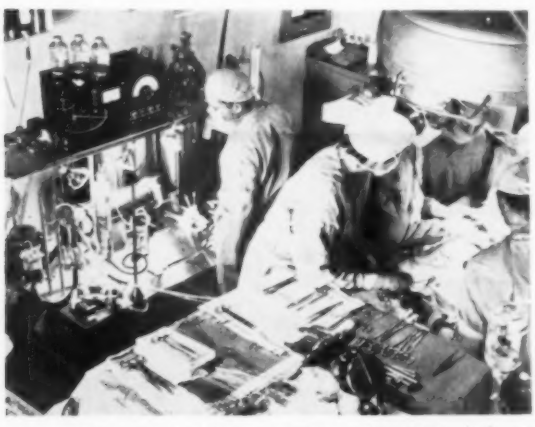


Fig. 1. Photo of actual heart operation using staff-built heart-lung machine (left) having Teflon parts.

Doctors at the Denver Center thus have a surgical mechanism which performs more reliably during delicate heart surgery, parts of which are easier to sterilize at high autoclave temperatures and, being frictionless, will not injure sensitive blood elements.

Since Teflon cannot rust and is inert to most chemical reactions, it has enabled doctors to reduce maintenance time and cut substantially into heart repair costs.

The Teflon was supplied by our company's Plastic Products Division through its Denver sales representative.

Besides being a Teflon processor, Raybestos-Manhattan also is a fabricator of Teflon parts and subassemblies. In this case, however, the firm acted solely as supplier, shipping molded rod stock to the B & B Manufacturing Co., also of Denver, who hand-formed and machined the parts.

Teflon in an especially high grade was needed to do the job. Specifications called for the solid Teflon stock to be uniformly dense, with absolutely no voids or fractures. Because of the nature of its applica-

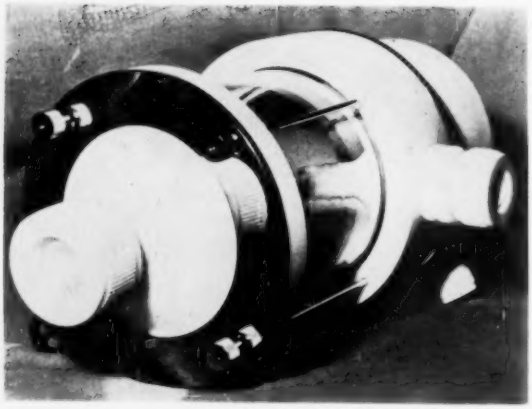


Fig. 2. First of two venous reservoirs used in heart-lung machine. In use, this reservoir stands upright, and serves as an intermediate vessel. Chamber is fabricated in one piece from large-diameter molded Teflon rod.

tions, the stock also had to be unusually clean.

The B & B Company never before had worked with Teflon. On special order from the doctor-designers, the company made from the material several types of Y tube connectors, bored to provide wall thicknesses ranging from 0.002 to one-quarter inch; hand-routed end plates for the main oxygen chamber and other reservoirs; bubble trap plugs, end plates for a venous debubbler, and 13 other parts used in this device; a sump chamber and plates for a venous reservoir; arterial Y-tubes; straight connectors of assorted types and sizes, many with threaded ends; tapered connectors; and sump tips.

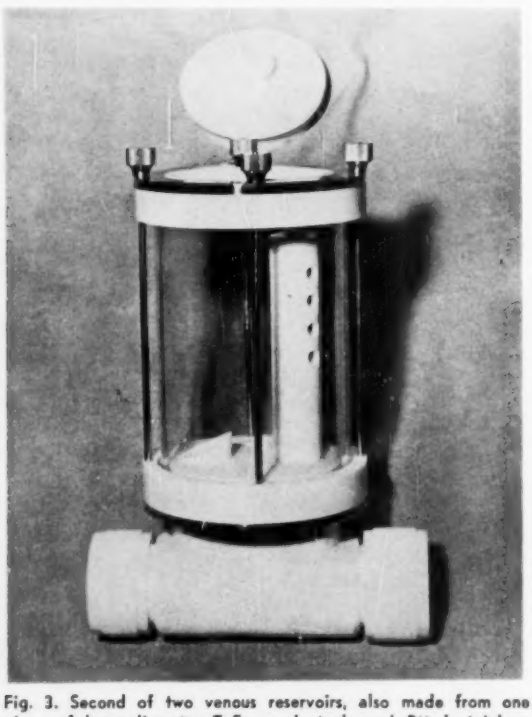


Fig. 3. Second of two venous reservoirs, also made from one piece of large-diameter Teflon rod stock, and fitted stainless-steel retainers. Underside of the chamber holds a joined connecting plug which feeds the container.

Heart-lung machines, sometimes called heart pumps because they replace the heart in circulating blood, actually are blood oxygenators. They also have the very important function of "breathing" for the patient by adding oxygen to the blood and, at the same time, removing carbon dioxide, while surgeons, working in the chest cavity or thorax, repair structural damage.

The equipment gives doctors a dry field in which to work. A complete by-pass of the heart is achieved by connecting the patient to the pump through one of the femoral arteries in the groin for inflow, and from the body by means of connections through the right atrium of the heart into veins which supply the inferior and superior vena cavae. Thus by-passed, the heart may be drained and its normal beating action slowed or stilled completely by the injection of acetylcholine, a potassium drug, which prevents it from beating.

Secure in the knowledge that the heart pump is breathing for the patient and supplying his whole body with life-sustaining oxygen, surgeons can then open the heart, remedy structural defects, close the wound, and prepare to return normal heart function. Before the operation is begun, clamps are placed on the coronary arteries to permit by-passing the heart. After surgery is completed, the clamps are removed, and the return of nearly normal blood pressure serves to re-activate the heart action which, at the same time, flushes the drug from the heart chamber and restores normal beating.

The equipment in use at Denver is primed with blood prior to patient hook-up. For children, 6-16 pints are used, while priming for adults requires 14-18 pints. This is the amount needed to fill all working chambers, reservoirs, and tubing. This amount, excepting variable, but small, blood loss during surgery, remains when the operation is completed.

The idea of the heart pump is not new, the first one having originated in 1938. There were many technical obstacles to be overcome before the mechanism could be used safely, however, and it was not until the late 1940's that further development made its use on humans possible. Rather extensive use of the present version received its impetus in this country starting in 1952.

There are four basic types of heart pumps: rotating disc; bubbler; stationary screen; and membrane. The first pump used at Colorado General Hospital was built four years ago by members of the staff of the Department of Surgery. The current disc oxygenator in use there, now unique in its Teflon operating elements, was designed about a year ago.

All heart pumps seek to accomplish the same end, that of getting carbon dioxide out of the blood and oxygen in by passing circulating blood through an oxygen atmosphere, thereby transforming the oxygen from a gas into a liquid. This is done through the cylindrical blood-oxygenator and many receptacles and monitoring devices.

The intricacies of the full oxygenating cycle are what make Teflon so desirable for heart-lung and other surgical equipment. Lung machines allow no margin for error. Operating elements must be abso-

lutely sterile, absolutely predictable, and virtually foolproof. Surgeons working in an open heart, with a human life in the balance, must be able to rely on the performance of their breathing apparatus and their skills.

After four years of use at the C.U. Medical Center, doctors became increasingly conscious of the necessity for continuous machine overhaul. Their equipment frequently rusted out, its jointed areas collected dirt, were difficult to sterilize, and it was impossible to control corrosion of operating elements.

The Center's laboratories and doctors knew about Teflon, knew its characteristics. They knew it was inert to blood chemicals, was extremely lubricious, and thus wouldn't traumatize or rupture the delicate red corpuscles. They also knew the material was long-wearing, self-lubricating, and impervious to both heat and cold. Determined to try the material in their pump as a corrective measure, they contacted Denver's Raybestos-Manhattan supplier and, through him, ordered over 100 pounds of block Teflon. They turned this over to the B & B Company for machining.

Y-tubes were milled out of solid rod, machined further, and bored by drill press. End plates and more detailed sections were milled, machined, and then hand-routed to specifications. All fabrications were made from single pieces, a hospital requirement. The work was done on special order, and many copies of each part were made. The results were so successful that the Center is eyeing still further conversions to Teflon.

The by-pass of the patient's heart begins with the insertion into a groin artery of a Teflon cannula or tube. The tubes used are tapered, and are available in various diameters to accommodate a size range from infants through over-large adults.

Meanwhile, surgeons open the chest cavity. An incision is made into the right atrium of the heart and two tubes, or cannulas, inserted to effect the by-pass. With the heart sac opened, clamps are fixed to the coronary arteries, shutting them off. The cannulas are made of Teflon and join to a Teflon Y tube, fitted, in turn, to a five- or six-foot length of Mayon tubing of clear plastic. The outflow of blood now commences,

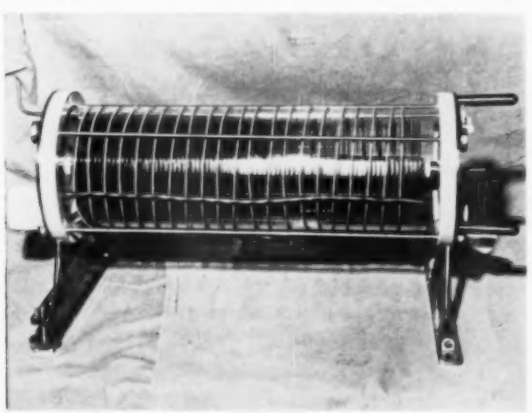


Fig. 4. Front view of blood oxygenator, showing Teflon end plates fitted with stainless-steel attachments. Center shaft is covered with a Teflon sleeve that retains many stainless-steel discs which rotate through the blood basin at bottom.

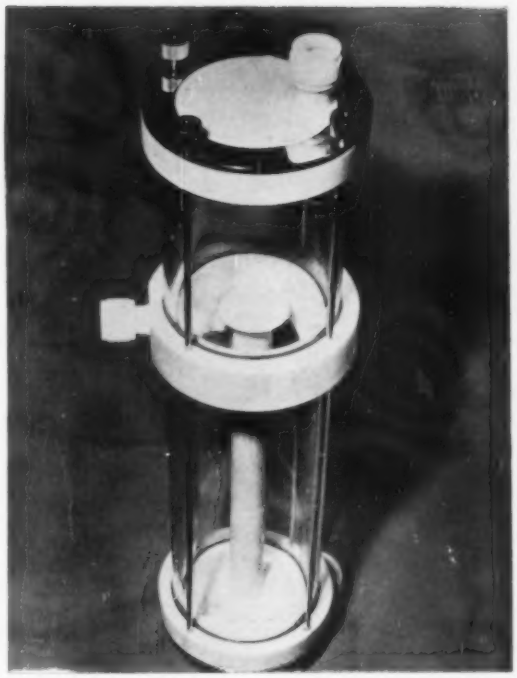


Fig. 5. Sump suction reservoir receives blood sucked from the open heart. The blood then goes to the first of the venous reservoirs.

feeding through this tubing and through a Teflon plug connector to which is threaded a pO_2 field-type electrode which measures the blood's oxygen pressure.

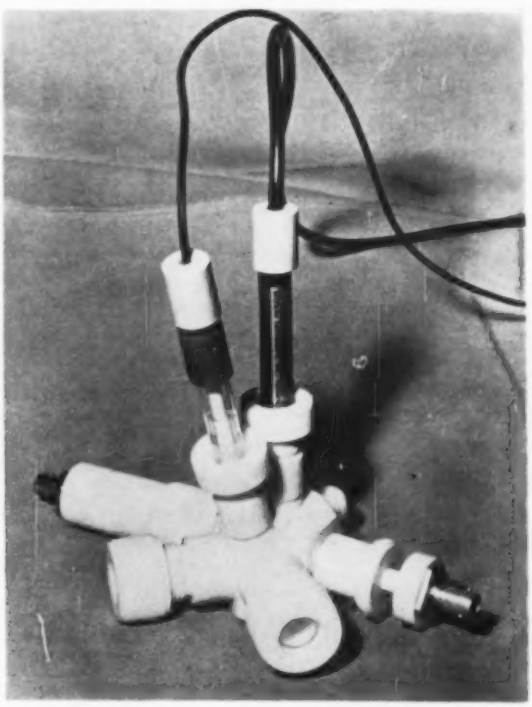


Fig. 6. Teflon Y-tube for use with blood monitoring devices.

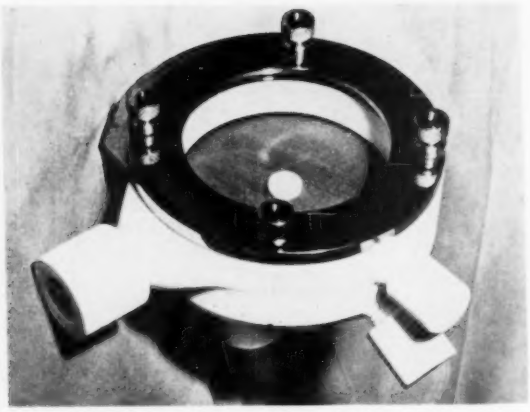


Fig. 7. Teflon-built bubble catcher or bubble trap to remove bubbles and contaminants from blood during heart-lung operation.

By gravity flow, the blood begins its journey through a venous reservoir (see Figure 2) into a second vertical reservoir of glass (see Figure 3) having a Teflon top and bottom plate which debubbles the fluid. The blood height is measured in the next device, the blood oxygenator itself (see Figure 4). This chamber, also of glass, has Teflon end plates which seal it airtight. Positioned horizontally, a shaft bisects it and is hitched by belt on one side to an overhead electric motor which rotates the shaft. Inside, stainless-steel discs attached to the shaft rotate through the blood reservoir, picking up a continuous film of blood which is exposed to oxygen and carbon dioxide, fed in by a tube.

A sump suction reservoir (see Figure 5) is used in the Denver heart-lung machine in conjunction with the two venous reservoirs. Made of Teflon top and bottom plates, a Teflon interior valve and threaded tube leads, the chamber's function during heart surgery is to receive blood sucked from the open heart. Blood so removed to this vessel then moves through tubing to the first of the venous reservoirs and, in due course, through the blood oxygenator and back into the patient. In operation, this vessel stands upright.

After rotation, the continuously-flowing blood feeds out of the chamber in two streams through a Teflon Y-tube and, thence, through a single-strand Mayon tube to monitoring devices which check the degree of oxygenation. Surgeons can determine the degree of oxygenation at this point.

The blood now goes through another Y-tube, bored to receive monitoring devices (see Figure 6). These include a meter for measuring oxygen tension, a thermister to check temperature, and meters to record the blood's pH factor (acidity or alkalinity). With these readings, surgeons can direct adjustments in the flow of oxygen and carbon dioxide, can slow or speed rotation of discs in the oxygenator.

From this Y-joint, the patient's artificial artery again becomes a one-strand Mayon affair, and feeds through the machine's pump apparatus, a device which simulates the heart's action and serves to return the blood, under pressure, back into the patient. To do this, the tubing feeds into the hard inner diameter of a U-shaped bucking surface. Here, it is rhythmically compressed, a process which pulsates the stream along much as the heart would. The same electric motor activates the bucking surface.

Prior to re-entering the patient through the groin cannula, the oxygenated blood is passed through a Teflon debubbling device (see Figure 7) which streams the blood through stainless-steel gauze, trapping bubbles and filtering out extraneous matter. Once through the bubble catcher, the oxygen-rich blood travels another short length of tubing and re-enters the patient.

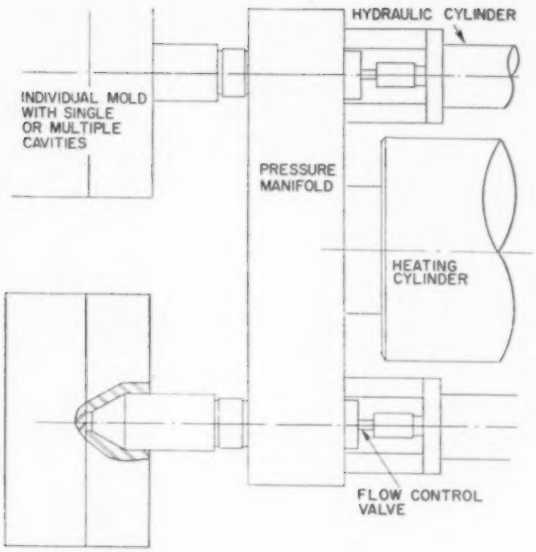
Heat and cold play a part in all Denver heart operations. While the heart-lung plant is in operation, heat lamps directed at the oxygenator itself usually maintains the flow at a temperature from 86-98.6° F. Prior to surgery, the patient is pre-cooled to lower his body temperature and, thus, his oxygen requirements. His temperature is dropped by artificial means from 37° to 30° C. (the equivalent of 86° F.). Upon completion of surgery, electric diathermy returns the temperature to normal.

At every point in this intricate progression, which may take an hour or more, Raybestos-Manhattan's Teflon is a factor and is in a critical location. Because it is super-smooth, it cannot injure blood elements; being inert to heat, it is stable; being plastic, it never rusts; is easy to flush clean; and, after high-temperature sterilization, can be handled within 10-30 minutes. Further, the intrusion of Teflon into intimate and fragile tissues of the body causes no tissue trauma or irritation, and, since it will not deform, will not rupture enclosing tissue.

Up to now, Denver has used its miraculous, Teflon-equipped heart pump mainly for repair of structural defects and congenital malformations which, in the case of young children, often doomed them to invalidism or premature death.

Members of the Department of Surgery at the Colorado University Medical Center foresee a time when heart surgery, using pumps of this type, either singly or in tandem, will be possible on patients with acquired heart defects—so-called heart disease—or those types of heart involvement which, without surgery, might lead to sudden death. —THE END

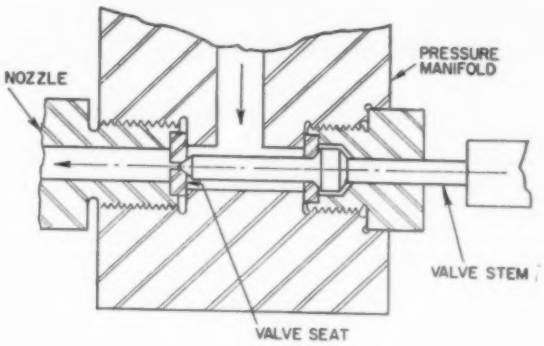
Spencer's Nylon-6 is being used as an in-line gasoline filter and housing on the 8-cylinder 1960 Plymouths, Dodges, DeSotos, Chryslers, and Imperials.



Cross-sectional view of typical nozzle valve.

First Prize—Class I
"Sequential Impact Molding"

Two-nozzle set-up for Sequential Impact Molding with two separate molds.



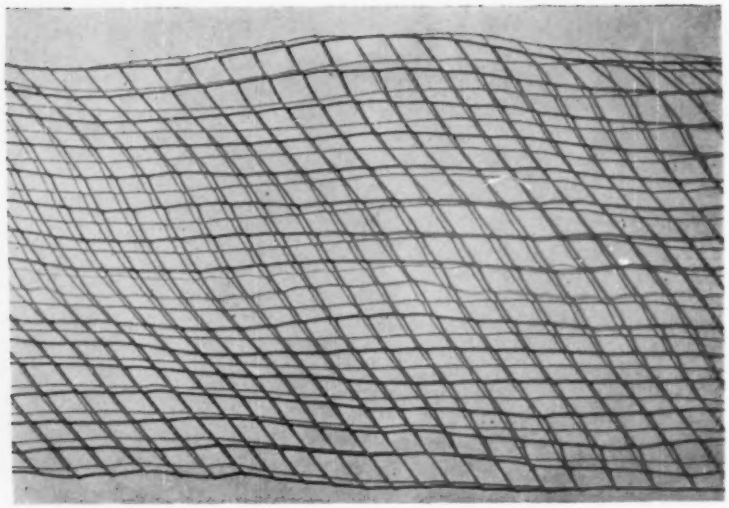
Winners Selected in 1958-1959

Achievement Awards Competition

WINNING entries have been selected in the competition for the first series of Achievement Awards in Plastics Technology, 1958-1959. The winners were chosen by the three-man panel of judges, Professor Louis F. Rahm, Henry M. Richardson, and Dr. Irving Skeist. The awards were presented in a special ceremony held on January 13, 1960 at the Conrad Hilton Hotel, Chicago, Ill., in conjunction with the 16th ANTEC meeting of the Society of Plastics Engineers, Inc., also held in the same hotel on Jan. 12-15, 1960.

In the Class I category (New Developments in Plastics Processing), First Prize was awarded to Bopp-Decker Plastics, Inc., Birmingham, Mich., for their process of "Sequential Impact Molding," invented by G. D. Gilmore and Judson Decker who are VP-Engineering and VP & General Manager, respectively, for the company. This process, which will be described fully in a future issue of PLASTICS TECHNOLOGY, utilizes fast-acting, timed valves in multiple nozzles to precompress the molten plastic material in an injection cylinder and then literally explode the melt into each mold cavity for a great increase in the filling rate S.I.M. increases output; permits reduction of temperatures and molding cycle times; eliminates core shifting and weld lines; gvies moldings with better physical properties; reduces clamping requirements; simplifies molding controls; and reduces tooling costs. In essence, S.I.M. offers different advantages for different molding applications not previously available, and opens the way for radically new approaches to molding technology and machine design.

Honorable Mention in the same category was given to Nalle Plastics, Inc., Austin, Tex., for their Naltex Netting made in a continuous plastics extrusion op-



Honorable Mention—Class I
"Extruded Naltex Netting"

Fish size netting with straight warp and angle weave.

eration developed by G. S. Nalle, Jr., president of the firm. The mesh is made directly from the extruding die head. A reciprocating die with a multiplicity of orifices extrudes filaments which are woven and welded to the adjacent filaments, thus forming a mesh pattern. Flexible tubes connect the extruder to the moving parts of the weaving machine. The type of netting produced can be varied by changing the plastic resin to affect mesh rigidity, and the type of weave used in the netting mesh. This operation was described in our July 1959 issue, pg. 54.

In the Class II category (New Developments in Plastics Fabricating), First Prize went to Titeflex, Inc., Springfield, Mass., for their development of Springfield 400 flexible hose, emphasizing the many fabricating operations involved. The fabrication methods were described in our December 1959 issue, pgs. 58-9. Fabrication of this large-diameter hose utilizes . . . a unique combination of tetrafluoroethylene resin (TFE) tape and TFE-impregnated fiberglass tape for corrosion resistance, strength, and resistance to flexing breakdown in the finished hose. The two plastic tapes are wound together simultaneously to form a special tubing which is then turned through a die to impart a spiral convolution to the hose innercore. This combination is inserted in an oven maintained at the fusion temperature of the TFE (tetrafluoroethylene) resin to fuse the two tapes together into a homogeneous mass. Finally, the cooled innercore is reinforced with stainless steel wire braid for added strength and protection. The finished hose has a bend radius of only 3½ times the inside hose diameter.

In addition to the three winning companies mentioned above, we wish to take this opportunity to express our appreciation to all of the other firms taking part in the competition who entered their developments for the Awards selection and judging.

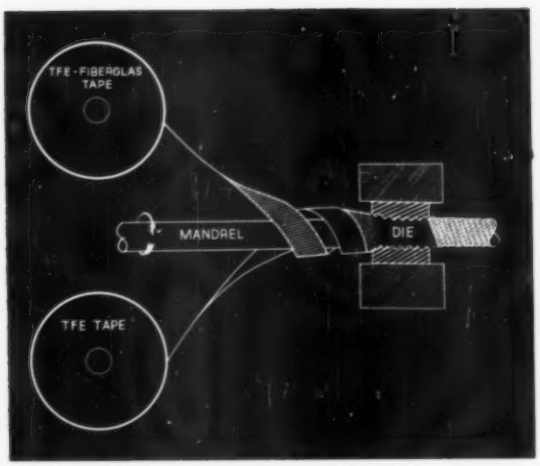
Professor Rahm, chairman of the judges, is Professor of Mechanical Engineering at Princeton University. In addition, he has been Director of the Plastics Laboratory at Princeton since 1945. A native of New Jersey, he attended the University of Michigan, receiving a B.S. in Mechanical Engineering in 1921. After graduation, he was employed by DuPont Viscoloid Co. and by Picatinny Arsenal. From 1923-26, he was an instructor in engineering for the University of Illinois. He came to Princeton University in 1926, and served successively as Instructor, Assistant Professor, Associate Professor, and then in his present rank as Professor.

4½-Inch extruder with die for making netting. Note flexible tubes to moving parts and complicated drive mechanism.

Mr. Richardson graduated from the University of Colorado in 1925 with a B.S. in Electrical Engineering. After graduation, he joined General Electric Co. and was with that company until 1943, ending as Chief Engineer in charge of all engineering development and research work carried on in all five G-E plants. Since 1943, he has been a principal in DeBell & Richardson, Inc., and a consulting engineer to the plastics industry.

First Prize—Class II
"Springfield 400 Flexible Hose"

Springfield 400 flexible hose.



Drawing of operation in wrapping and the forming convoluted hose inner-core.

Dr. Irving Skeist is a chemical consultant specializing in plastics. He received a B.S. in Chemistry from Worcester Polytechnic Institute, and an M.S. and Ph.D. in Polymer Chemistry from the Polytechnic Institute of Brooklyn. He has been Research Chemist, Marketing Specialist, and Technical Director with Celanese Corp. of America, Gering Products, Inc., Americal Molding Powder & Chemical Corp., and Newark Paraffine & Parchment Paper Co. Dr. Skeist is a Registered Patent Agent, and is the author of the book, "Epoxy Resins." At present, he is Vice President of Skeist & Schwarz Laboratories, Inc.

The second series of Achievement Awards in Plastics Technology, 1960-1961, is now under way. As with the first series, entries will be judged in Class I and Class II categories, also as mentioned above. Official entry blanks for the 1960-1961 will be available shortly. The closing date for our receipt of all entries will be December 15, 1961, and the entries must be on developments achieved in either 1960 or 1961.

THE JUDGES

Louis Frank Rahm

Dr. Irving Skeist

Henry M. Richardson

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By L. J. ZUKOR, *Engineering Editor*

Pipe and Tubing . . .

. . . is one of the current major markets for polyethylene. Because of its remarkable resistance to corrosion, polyethylene pipe is being employed to convey a great many solutions and slurrys in both industry and agriculture.

The first polyethylene pipe was extruded from low-density material, and this limited its use to "cold-water" service. When high-density (linear) polyethylene became available, pipe extruders were the first manufacturers to add high-density material to their lines. Linear polyethylene extended the temperature range to include "hot-water" service. Since then, this material has been used experimentally in competition with metal pipe in radiant heating coils. Other volume outlets have been developed for polyethylene pipe in mine service and for installations in freezing plants. Some unique applications include maple syrup collection systems and deep well piping.

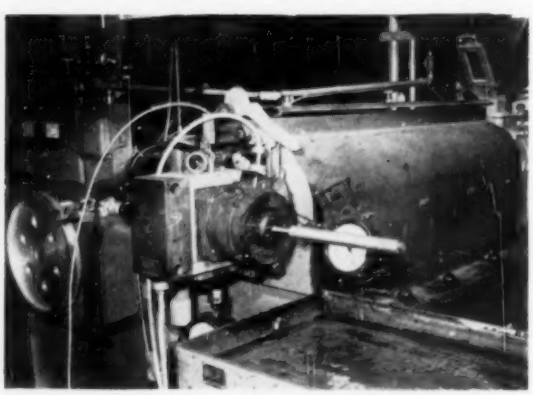
While extruders have been finding new uses for their tubing and pipe, the material producers have been busy carrying on accelerated laboratory testing of their new formulations. One of these, Hercules Powder Company, producer of Hi-Fax linear resins, has set up pipe extrusion equipment in its laboratories in Parlin, N. J. Here, full scale testing for environmental stress-cracking (ESC) is carried out in close conjunction with extrusion work. This is particularly important in pipe extrusion, since failure from ESC would be equivalent to failure from corrosion or burst. Resins which resist ESC are the ones that are tested further for extrudability.

Machine conditions for the extrusion of pipe and small-diameter tubing resemble those for heavy gage film or wire coating, except that much faster take-off rates can be used. Dies, take-off, and wind-up equipment are simple and present few problems.

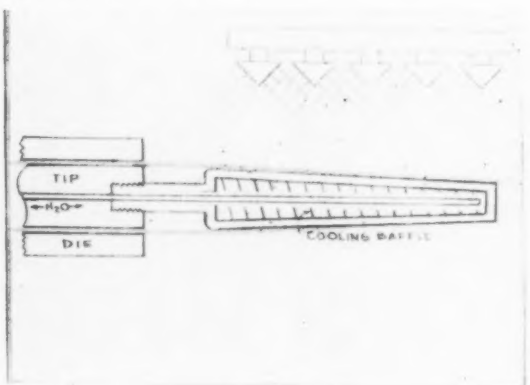
In pipe extrusion, a molten tube leaves the die and is chilled so that a chain puller can be attached. With the wind-up equipment in operation, the pipe is cooled to room temperature usually by passing through a chilled water trough to the wind-up reels. However, to meet specifications, pipe must be properly sized. Hercules has found three basic methods useful in sizing Hi-Fax pipe. It should be noted that the successful method for sizing linear material may not be the best method for other grades of polyethylene.

The methods investigated in the Parlin Laboratories are inside mandrel, outside ring, and outside tube.

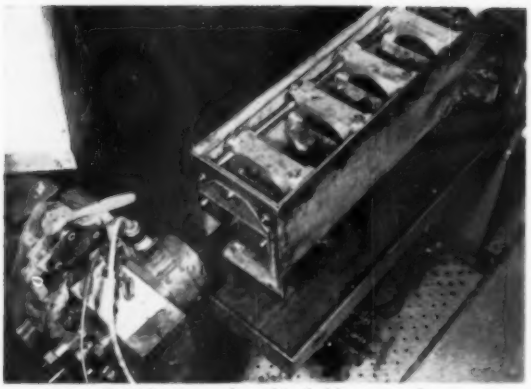
The inside mandrel is a tapered extension of the die tip which is cored and baffled to provide a means of temperature control. The extrudate is drawn over the mandrel while water cascades over it. This causes the polyethylene to shrink down onto the mandrel. In the ideal situation, the pipe grips the mandrel just tight enough to polish the inside surface, but not tight enough to break under the load of the pipe puller. A water bath is used to cool the pipe further. In order to maintain roundness at high draw-off rates, it is sometimes necessary to insert several sizing rings at strategically located points in the cooling bath. These rings should be approximately the same size as the desired O.D. of the pipe, since their function is not to size but to hold the pipe in round.



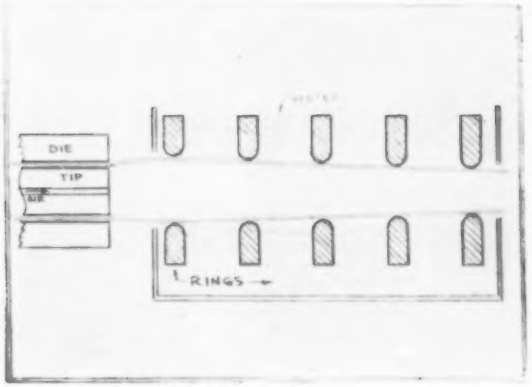
Inside mandrel shown attached to cross-head die.



Inside mandrel diagram.



Outside ring adjustable holding trough.



Outside ring diagram.

In start-up, care should be taken to keep water from getting inside the extruded pipe. It is also important to keep the end of the pipe open to prevent a vacuum from forming at the end of the mandrel. The cascade of water should be applied gradually starting at the end farthest from the die and proceeding slowly toward the die to a point just short of where the pipe begins to stick to the mandrel.

In the outside ring method, the die tip is drilled through for an air passage. At the opposite end of the die a connection is made for an air hose. Controlled air pressure is then fed through the die. As the polyethylene pipe is extruded, its end is sealed and internal air pressure is applied to cause a slight bulge. At a point about 10 inches from the die, the pipe enters a water bath through the first sizing ring. This is a ⅛-inch steel plate gasketed and attached to the trough, and having a controlled diameter hole at its center. This ring is, in turn, followed by a series of rings with gradually reduced diameters.

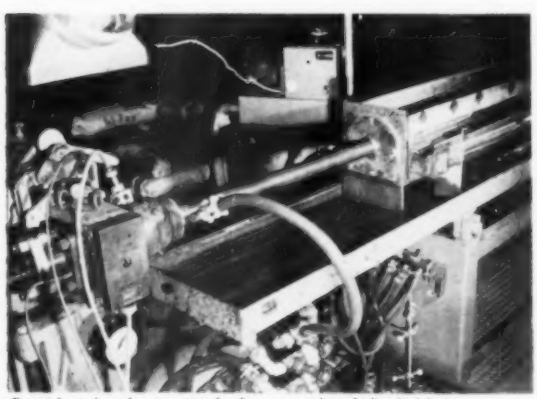
The above-mentioned rings are spaced at intervals in the water trough. The outside diameter of the pipe is reduced as it passes through each ring of the tapering series. The taper of the rings and their distribution depends on the rate at which the pipe is being cooled. In the first section of the bath where the pipe rapidly cools and shrinks down at a fast rate, the rings necessarily are sharply tapered. Farther along, this taper levels out to the desired outside diameter. Additional rings of the desired outside diameter dimension are used to hold the pipe in round until it is completely set.

The outside tube method can be worked with internal pressure or with a vacuum drawn between the O.D. of the extrudate and the I.D. of the cooling tube. Of the two variations, the former is the easier method and nothing is gained in better product from the vacuum counterpart. By the pressure method polyethylene pipe is sealed and internal air pressure is applied to expand its O.D. and force it against the inside surface of the tube. The tube is cooled externally by circulating cold water which acts as a heat exchanger. As the cooled skin on the pipe rubs against the inside of the tube, its surface is highly polished.

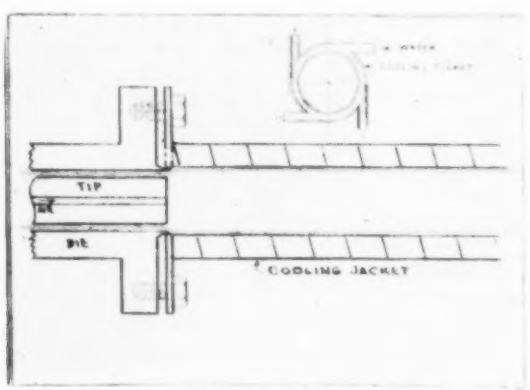
A general evaluation of each method points up the fact that the inside mandrel is the best all-around method for sizing pipe. An exception would be where outside smoothness and gloss are a major requisite.

Two drawbacks are common to the other methods. Both use internal air pressure which requires that the end of the pipe be sealed. Each time the pipe is cut, a new seal must be made. At high draw-off rates, sealing is not only cumbersome but also results in waste pipe at each seal. In the outside ring method, streaks and pock marks on the O.D. of the pipe can occur and cause reject pipe.

Photos and diagrams: Courtesy Hercules Powder Co. —THE END



Outside tube shown attached to cross-head die holder



Outside tube diagram.

Edited by:
HARRY T. DOUGLAS
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Reinforced Plastics Underseas Explorations—

Another Untapped Potential for Reinforced Plastic Materials

PERHAPS there were times when readers of this column thought that some of the predictions made for the promising and broadening uses of fiberglass laminates sounded like something for science fiction. In looking back, however, they must admit that many of the reinforced-plastics usages highlighted as possibilities then, have since become realities.

I could do a parallel flash-back to illustrate the increasing uses by the military services, especially the Navy, and by industrial outfits in areas described by some in the past as "highly imaginative," but that comparative study would be 'old hat' now since our readers are aware of the almost miraculous achievements made by reinforced-plastics materials.

In keeping with the theme that reinforced-plastics materials have almost limitless applications, I would like to re-examine with the readers the vastly interesting world underseas which has only lately been making news in our "space-minded" world. Many authorities believe that we are over-emphasizing the importance of space explorations and space travel, that aside from weather and arbitrary military strategy, the space research program offers little to us in actual practical applications, as compared to the great potentials existing for food, minerals, drugs, mining, farming, etc., which are claimed to be relatively more accessible on the ocean floor than in outer space.

If we categorize the present research, we will easily see how fiberglass products could be adapted to many applications in underseas scientific programs because of the materials' inherent characteristics of strength, durability, non-corrosive and light-weight qualities, among many other outstanding contributions ideally suited to marine use.

For example, Vice Admiral C. B. Momsen is a staunch believer that the ocean holds hopes for man's future in the following realms, all of which, of course, are of logical interest to reinforced-plastics material suppliers, designers, and fabricators:

(1). Conversion of sea water into fresh water, pumped inland and used to irrigate desert regions into fertile lands. (Fiberglass pipes, ducts, tanks, and allied equipment will find a market here.)

(2). Fish and sea-vegetable "farms" will supply much food to the world's exploding population, increasing at a rate of 100,000 per day. (Surely much of the harvesting equipment for such "agricultural" use will be made of laminated fiberglass.)

(3). Hundreds of passengers will speed by submarines to and from the United States and Europe at 225 miles per hour. (Submarine components in larger sizes and larger quantities have been molded successfully of reinforced-plastics materials.)

(4). Submarine cargo ships will cross under the ice cap at 70 miles per hour transporting millions of gallons of oil and other materials through shorter distances in container-like "freight cars." (Another "natural" for fiberglass chemical tanks designed for pressure and strength.)

(5). Electrical power will be created by the force and action of tides, waves, and currents and will be converted into electricity in underwater power plants. (Gigantic fiberglass laminated structures have endured severe weathering conditions in many parts of the globe. The challenge of underseas applications for reinforced plastics materials in power plants captures the imagination.)

(Continued on page 57)

Edited by:
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Compression & Transfer Molding

Automate To Stay Alive

IN this issue, the reader will find an article entitled, "Automatic Plunger Molding." Bouquets are in order for the author, J. A. Kempf, and his staff for their vivid description of the mechanization and requirements for automatic plunger molding. Mr. Kempf altruistically tells us the story. Perhaps if more molding establishments were willing to serve the plastics industry in this way, the mutual benefits derived would motivate more rapid progress in the plastics molding industry.

A few months ago, the writer made a routine telephone call to Mr. Kempf. During the conversation, he mentioned that he and his assistants had written an article on their automatic operation. Mr. Kempf also indicated that their operation had been so successful that he felt like telling his colleagues in the plastics molding industry. Was it possible to publish his article? Certainly. Efforts of this type are commendable. It was only a question of the first available space.

Mr. Kempf started his plastics career in Chicago and went with Bulldog Electric about five years ago. He is on a constant lookout for methods of automating. At present, he is planning on setting up automatic deflashing so that the molded part may be packed right at the press. Who knows, he might even work out a method of automatic packing and carton sealing! Every automatic method he installs is based on the universal usage, rather than on the particular application.

Since many of his runs are short, he has had to derive techniques for quick set-ups. An integrated mold of his design can be anchored into a press in a matter of 15 minutes, according to Mr. Kempf. As he points out in his article, there is little additional cost in an automatic plunger mold set-up. Once the initial equipment is installed, all new molds are designed to be adaptable.

At present, preforms are loaded into a vibrating Syntron. These preforms are vibrated up and into position for preheater loading. Preheating and loading in the open plunger pot is done automatically. Mold closing, plunger action, cure and ejection continue routinely. In this set-up, it might be said dramatically that one action begins another as the automatic process continues in its cycle.

It is only proper to mention that besides the Rodgers type of molding presses, Stokes, Baker, and Hull-Standard presses also are among those adaptable to automatic plunger molding. Molders wishing to invest in small horizontal plunger molding automatics may well look into the Hull-Standard press. The writer has witnessed general-purpose epoxy molding compounds work very well in this type of press.

All in all, it is a good idea to investigate automation. The new models are set-up for fast closes, long stroke, and simplified mold installation. Otherwise, presses on hand can be re-engineered. If the conversion to automation is gradual, the capital outlay will not decrease the reserves drastically.

The author recommends only partial conversion. There are parts which do not lend themselves to automation. There are materials that cannot be handled automatically. Some automation is necessary in every plant to reduce piece-part costs. Mr. Kempf's last sentence in his article reads, "If your research is thorough and honest, you can reach but one conclusion: your plant must accept and prepare for immediate advances in automation to stay alive."

—THE END

Edited by:
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Moldmaking & Tooling

Latest Developments in the Construction of an Injection Mold

THIS article is intended to acquaint the pen manufacturers and their engineers with the latest developments in the design and the construction of an injection mold to make a barrel for a fountain—or ball-point pen. Let us assume the product is designed so it may either be center-gated or tunnel-gated on top of the barrel and the external threads molded.

In the preliminary discussion with the molder, a decision has been reached to construct a 32-cavity injection mold, three-plate construction, incorporating the features of automatic degating, automatic unscrewing of the threads, and balancing of the system to meet high-production requirements. Design of the mold was adapted to fit three different injection machines, of the latest type to take advantage of all existing machines in the plant. Let us now describe the various components.

The outer shape of the barrel lends itself to the use of the hobbing-method of producing multiple cavities in a good grade of hobbing steel. The tool used for obtaining the hobbings is called the hob, and is machined precisely and hardened in accordance with the contour of the product and the specified dimensions, including the shrinkage factor. Also, the hob takes several other factors in consideration for the expansion or contraction experienced in the heat-treating of the cavities. The hobbings are produced by the hobbing operation, using the hob in a special set-up, wherein it is pushed into the cold steel under hydraulic pressure up to a certain tonnage per square inch. This operation is performed under the watchful eye of an experienced operator. After such necessary machining operations as turning, milling, heat-treating, grinding, etc., has been performed, the impressions of the cavity must be polished to a 4v micro-finish, and then inspected for finish and adherence to the specifications set forth.

The core component consists in this particular application of the two parts, one stationary and one rotating. The stationary part contains the specified thread which may be a single-, double-, or triple-thread; sometimes a quadruple-thread. The rotating member has a series of fine grooves or projections on the circumference of the core acting as drivers for the unscrewing. These two parts usually are made of a non-deforming, air-hardening, tool steel. After the various machine operations conforming the part to the specified dimensions, they also shall be polished to a 4v micro-finish on the molding area only. Some requirements specify chrome-plating for wear. After stress-relieving the chromed and machine areas, they receive a special treatment to prevent galling of the moving and rotating parts. Cooling of the core pins is quite essential providing the required diameter is not too small (which would make it impractical due to the necessary drilling of the core pin for the channel).

Another important factor is the interlocking of the upper cavity with the lower one or stripper bushing, depending on the design of the product to be molded, on the main parting-line of the mold.

The aforementioned components are then fitted to the frame in accordance with the specified close tolerance fit between the various retainer plates and components. Special emphasis is given to the running fit between the two stationary and rotating members to be 0.001 to 0.0015-inch.

The frame, consisting of several retainer plates to receive the various components, is sufficiently cooled by providing channels in each plate. Cooling channels may be drilled in one direction and cross-drilled for connecting the channels within the frame size. The

latest achievements are; a manifold design of channeling with an inlet and outlet feeding several cooling channels in one direction, or provide channels in either direction on two levels for maximum cooling capacity. The last two-mentioned cooling arrangements can be controlled easily for the best mold temperature required for the shortest cycling. All retainer plates are either made of prehardened steel with a Rockwell hardness reading of C-30, or are fully-hardened to C 50-55. Depending on the selection of above, they are jig bored throughout or jig ground to a tolerance of 0.0005-inch. The plate thicknesses are held within a tolerance ±.0002-inch. Therefore, there is some degree of interchangeability of components as to the final unit achieved. The leader pins and bushings are perfectly aligned, and in cases of a sliding-cavity retainer plate, special ball-bearing bushings are used to assure a smooth function of the mold openings.

The housing containing the unscrewing mechanism is designed in a manner so it might be used as standard equipment for several suitable molds. Timken bearings are used throughout to maintain rigidity and keep the worm, worm gear, and shaft aligned. Aside from proper alignment in the housing, the lower end of the core pin is aligned with two ball-bearings and one thrust bearing.

The unscrewing mechanism is actuated by a small hydraulic motor mounted on the side of the housing and coupled with the main shaft of the driving mechanism. This hydraulic motor may be hooked up with the main pump of the injection machine or, preferably, a separate pumping unit is set-up to feed several motors. This hydraulic set-up is simple, quite fast, and should assure less maintenance and longer trouble-free life than an electric motor with a short-interval start-and-stop condition made necessary by the repeating cycle (of unscrewing the threads).

The balanced runner system feeding the individual cavities through the gate inlet, many times being a separate plug inserted into the end of the cavity for easier replacement, is between the plates which open first in the sequence of mold separation. The parts are degated by an undercut pin to pull the secondary sprue of each cavity. Then, the entire runner system is stripped off the pins, allowing them to fall free in the opening provided. As a safety measure, one should use a wiper bar (aluminum construction) actuated by an air cylinder and mounted on top of the stationary platen.

In conclusion, let me note that there are many other features that could be added to a mold as described above, but the main features outlined should give the molder an excellent tool for high production. Although the tool cost may be high, it certainly pays for itself in a relatively short time.

—The End

Reinforced Plastics
(Cont'd. from page 54)

(6). Submarines will harvest from the ocean floor varieties of minerals, such as gold and copper, plus essential vitamins and food from plant and sea life. (Another not far-fetched area for reinforced-plastics materials is spheres, such as Dr. Piccard's Bathyscaph, which are combing the ocean bottom now for more data.) It has been reported that a new type of submarine is being developed which is expected to descend beyond 10,000 feet.

Dr. Ross Nigrelli, head of the Laboratory of Marine Bio-Chemistry and Ichthyology of the New York Aquarium, is one of the pioneers in underseas scientific experiments. Recently, Dr. Nigrelli reported that the lowly sea cucumber, not a vegetable at all but a member of the star fish family, has yielded some amazing secrets. One of these is a complex chemical that produces a nerve-blocking action which might be desirable in some forms of medical treatment. Another surprising discovery is the amazing reaction this chemical has on some forms of cancer cells. Other experiments with which he is associated are the poisons found in plankton that might be processed into pharmaceutical compounds of various kinds. These illustrations indicate the broad areas in which intensive research is underway and which may open many new vistas for reinforced-plastics materials in underseas applications.

Sir Charles Darwin, prominent mathematician and grandson of the famous Charles Darwin, advised the public only recently that the earth soon would not be able to support the ever-increasing population growth, and that it would be illogical to transport them to some distant planet for resettlement; therefore, we have to consider the sea as a necessary food source.

If we are to be guided by the experience, wisdom, and predictions of these learned men mentioned, and by many others like them, we should be able to realize that a tremendous new field exists for reinforced plastics, perhaps more so for this non-critical material with its designability, moldability, and strength, than for any other substance known to us on earth. And, again, we can say that we are on the threshhold of many potentials which will materialize in the near future.

—The End

Automatic Plunger Molder
(Cont'd. from page 44)

ics are self-evident. Compare for yourselves the following:

(1). Mold costs. Aside from the extra for hardened back-up plates, which are insurance for mold protection and continual performance, these mold costs are equal.

(2). Initial costs. These consist of the cost of equivalent press, the cost of preheater, the cost of press and unloader, and the cost of preheater feeder unit.

(3). Operating costs. These consist of the press operation, the preheater operation, the labor (press operators), the press set-up time, the press output, and the press maintenance; and the press unloader preheater operation, the press set-up time, the press output, and the press maintenance.

Conclusions

American business is moving on the escalator called "Automation."

If your research is thorough and honest, you can reach but one conclusion—your plant must accept and prepare for immediate advances in automation to stay alive.

—The End

NEWS of the Industry

business developments

American Can Co.'s president, William C. Stolk, feels that 1960 will be a record year for all those participating in and affected by the packaging industry. He also stated that the coming year will see exciting new developments in both plastics and paper packaging.

Atlas Powder Co.'s Dr. Joseph E. Wilson prophesies greater refrigerator and freezer storage space within two years through the use of polyurethane foam insulation. Since these foams permit thinner walls, internal food storage space is increased by about 30%. Atlas produces sorbitol, a basic raw material used in rigid urethane foams.

Celanese Plastics Co.'s president, Richard W. KixMiller, reported that high-density polyethylene attained a sales volume of 90 million pounds during 1959, and stated that Celanese is expanding its Fortiflex polyethylene capacity to 50 million pounds to meet anticipated demands. He also felt that the greatest impetus to its future market growth lay in blow molding which could require up to 200-250 million pounds of the material annually by 1965.

Ciba Co., Inc., has established a pigments division which will be located at Fair Lawn, N. J. Products will include a broad range of organic pigments, dispersions, and soluble dyes.

Dow Chemical Co. is offering carload shipments (100,000 pounds) of polyethylene in Dry-Flo hopper cars from the Texas division in Freeport. Extensive use of stainless steel in the compartmentalized hopper bottoms, plus a complete inner liner of epoxy resin, prevent product contamination. By using pneumatic conveyor units and storage silos, extruders and fabricators can unload a car in less than eight hours.

The Dyestuff & Chemical division of General Aniline Film Corp. has established a new and separate pigment department with Robert E. Brouillard as sales manager. Product manager is Leon Katz.

Eleonora division, Pantasote Co., plans to increase its PVC capacity by more than 300%. Twelve resin kettles have been installed, which will up capacity to 45-million pounds annually.

Monsanto Chemical Co. plans to increase production of styrene monomer by at least 200 million pounds per year. First stage of the new facilities, to be located in Texas, is expected to be in operation by early 1961. Eight other expansion projects are scheduled for four other Monsanto styrene plants.

Naugatuck Chemical division, U. S. Rubber Co., plans to raise its Marvinol capacity by more than 30%, to reach a figure of 65-million pounds annually. Capacity of the Painesville, O., plant has already been tripled in the past ten years.

Polymer Dispersions, Inc., has installed production facilities to produce polymer color concentrates and dispersions at Fairport Harbor, O. Sales will be handled by Harwick Standard Chemical Co., under the Harwick Stan-Tone trade name.

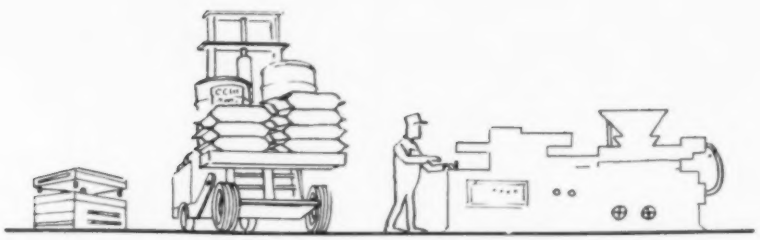
Taylor Fibre Co. has adopted the trade name Taylorite for its improved line of vulcanized fibers. These properties include higher density, better mechanical strength, dielectric strength, and lamination bond.

Union Carbide Plastics Co.'s president, R. K. Turner, stated in a year-end review that "the most significant trend in plastics during 1959 was the tremendous surge in the use of polyethylene film." He quoted production gains of over 75 million pounds more than 1958, and felt that the long-term outlook remains good.

changes in ownership & new companies

Bristol-Myers Co. is selling the assets and business of its wholly-owned subsidiary, **Kimball Mfg. Corp.,** to a new corporation founded by William R. Kimball. Bristol-Myers has decided to concentrate its activities in the proprietary drug field and, therefore, decided to sell the San Rafael, Calif., reinforced plastics division.

C. A. Litzler Co., Inc., has acquired the **Ovens for Industry division** of Ryan Industries, Inc., thus broadening



its line of continuous processing equipment involving heat transfer to cure and treat synthetic webs and other plastic materials.

Reichhold Chemicals, Inc., has announced its intent to purchase **Varcum Chemical Corp.,** Niagara Falls, N. Y., for an undisclosed amount. Varcum manufactures liquid, powdered, and solid phenolic bonding resins. It will operate as an RCI division, with former president George E. Lewis continuing in that capacity.

Studebaker-Packard Corp. has announced the acquisition of **CTL, Inc.,** Cincinnati plastics research and manufacturing organization. The latter firm pioneered in heat shielding of missile cones, and further involves S-P in the plastics field. Founders Elmer P. Warnken and Melvin N. Korelitz will continue to manage the CTL division.

news from abroad

Dow Chemical International Limited S.A. and Pechiney S.A. are building a multimillion dollar plant at Ribecourt, near Paris. Scheduled for opening in 1961, the plant will manufacture Styron and Saran.

B. F. Goodrich has established a European sales office at The Hague, Netherlands. Howard G. Womack has been named to head the new office.

Fried. Krupp, Essen, Germany, is supplying the Soviet Union with a plant for the manufacture of synthetic fibers. The plant includes equipment for producing paraxylene from crude xylene, a unit for conversion to basic materials, and a third facility for spinning fibers. The entire set-up should be in operation next year.

Japan produced 328,742 metric tons of plastic materials in 1958. Exports more than doubled, mainly due to the sharp rise in sales of PVC. Imports dropped to 27,629 metric tons, with polyethylene accounting for about 70% of this figure. Since three new manufacturers have joined the existing two manufacturers of this material, polyethylene imports can be expected to decrease drastically in 1959.

Monsanto Argentina S.A.I.C. has installed facilities for the manufacture of PVC compounds at its plant in Zarete, near Buenos Aires. Compounding operations are expected to get under way in the first quarter of 1960. The firm also plans to manufacture phthalic anhydride.

Plastics output in France was 197,810 metric tons in 1958, an increase of 26%. Polystyrene showed the greatest gains with a 45% increase. Polyethylene production is still so far behind the country's needs that two-thirds of the amount consumed must be imported. Great interest is shown in polyester resins, and a plant is being erected for the manufacture of fluorocarbon materials. Total French consumption during 1958 was 225,550 metric tons.

Reichhold Chemie A.G., Switzerland, is building a phthalic anhydride plant at Hausen bei Brugg. The $2.5-million unit will have a capacity of 10,000 tons annually.

Soviet engineers have developed a turbo-drilling machine, the chief components of which are plastics. Used principally for petroleum exploitation, it features reduced weight. Plastic bits used are said to be harder than steel.

S.p.A. Colene, a Sicilian company owned jointly by **Union Carbide** and **Societa Edison** of Milan, Italy, plans to double its polyethylene capacity. Located at Priolo, near Syracuse, the plant will have a capacity of 60-million pounds annually.

The International Plastics Exhibition, held in London during the summer, showed for the first time British-made polypropylene and Vyon, a high density polyethylene intended for air and liquid filtration and electrolytic diaphrams. Another attraction was a Danish Blow-O-Matic machine, said to be the fastest in the world. Also of interest were the 10-foot polyethylene dinghies made by a Scandinavian firm using the Engel process for large one-piece moldings and containers. They are cheaper than comparable polyester-glass craft.

Names in the News

Richard C. Dalton

Richard C. Dalton has been assigned to the newly-created position of production manager for molded and extruded products for General Tire & Rubber Co.'s Bolta Products division in Lawrence, Mass. He has been associated with Bolta since 1957 in the production control department. and most recently was assistant production control manager.

Monsanto Chemical Co. has announced the following appointments within its plastics division:

Luigi A. Contini as manager of market development; **Ralph F. Hansen** as assistant director of marketing; **Stanley L. Harris** as West Coast representative; **Theodore S. Lawton** as associate in the development department; **Edward H. Myers** as market specialist, packaging; and **Stuart H. Rider** as assistant research director. The following are new personnel—**L. John Berggren, Wilbur A. Brown, Thomas E. Daly, Jr., Newell H. Goodwin, Philip R. Lewis, Wallace L. Maurer, Earl D. Morre, Donald M. Stevens, Robert C. Busser, Paul E. Bureau,** and **Abraham A. Covo.**

Thomas E. Fritscher has been appointed field sales manager for Chippewa Plastics Co. Before joining Chippewa in June in an executive sales capacity, he was with U. S. Industrial Chemicals as a sales engineer.

George Dingman, director of purchases and planning at Chippewa Plastics Co., has been promoted to general manager. In his new position, he assumes administrative responsibilities for all operations.

Erhart K. Drechsel has been appointed manager of new product development at Escambia Chemical's commercial development department.

John T. Watkins, Jr., has been appointed general manager of Fabricon Products' plastics impregnating division. Other appointments include **H. Robert Lyon** as development engineer, **Kenneth Iseler** as supervisor of quality control, and **Roger C. DeNoyelles** as sales manager of the export department.

John Haskins has been appointed general manager of Fiberform, Inc., Oconomowoc, Wisconsin, manufacturer and supplier of melamine and phenolic laminating and specialty molding papers. He formerly served with Monsanto's plastics division as sales engineer.

Richard E. Elden has been named resident manager of Becco Chemical division, Food Machinery & Chemical Corp. He is succeeded as production manager by **Richard F. Braun.**

Charles J. Ford

Charles J. Ford has been appointed sales manager, Ensolite products, for the footwear & general products division of U. S. Rubber Co. He was formerly sales manager of products in development.

Marshall E. Doyle has been appointed a research supervisor at Shell Development Co.'s Emeryville (Calif.) research center. He will head a group in the thermoplastics department.

David Shopkorn

David Shopkorn has joined the sales staff of Kaye-Tex Mfg. Corp., Yardville, N. J. A 15-year veteran of the vinyl film and sheeting industry, Mr. Shopkorn is well known throughout the Eastern states.

Donald V. Magnuson

Donald V. Magnuson has been named plant manager of Structoglas, Inc., Grand Junction, Tenn. He had been director of engineering for Labline, Inc.

OBITUARY

Alfred W. Hanmer, sales manager of Durez Plastics Division, Hooker Chemical Corp., died suddenly on November 10 in Buffalo. Mr. Hanmer had been sales manager since the merger of Durez Plastics & Chemicals, Inc., with Hooker in 1955. He started with Durez in 1929 as a sales engineer, advancing to sales manager and later vice president of molding compound sales. From 1945 to 1955, he was a vice president.

A member of Plastics Pioneers, Mr. Hanmer was a director of the Society of Plastics Industry and a member of the plastics committee of the Manufacturing Chemists' Association. He also belonged to National Sales Executives and the Chemists' Club in New York.

Frank H. North, technical sales representative for Harchem division, Wallace & Tiernan, Inc., died on Saturday, November 21, 1959. He had served with Harchem since 1946, covering most states in the midwest and east. Lately, his activities were confined to New York, New Jersey, and Philadelphia.

Before coming to Harchem he had been with U. S. Rubber Co., Flintkote Co., International Plastics, and Marko Chemical Co.

Dr. William H. Schuette, a vice president of Dow Chemical Co. and general manager of its Midland division, died of a heart attack on Sunday, November 8, 1959. Beginning in the chemical engineering laboratory at Midland in 1941, Dr. Schuette advanced to manager of plastics production in 1952. Following his appointment as general manager in 1955, he became a director in 1957, and a vice president the following year. He was responsible for petrochemical, polychemical, and petroleum refinery operations of Saginaw Bay division, Bay City, Mich., and for four other Dow plants in the east and midwest.

A member of the American Institute of Chemical Engineers, American Chemical Society, Sigma Xi, American Management Association, and American Institute of Management, Dr. Schuette had served as Michigan chairman for Chemical Progress Week for the past four years.

The newest curing agent for the EPOXY family – from Jones-Dabney Co. where Epoxy resins were developed . . .

epi-cure 855

A New Flexiblizing Type Curing Agent For Improved Resilience

EPI-CURE 855 is a new and modified aliphatic amine curing agent for EPOXY resins, which has resulted from the continuing development in the Jones-Dabney Laboratories, where EPOXY resins were developed.

For casting compounds, laminated structural parts, potting and encapsulating EPI-CURE 855 provides several unique advantages.

Lower viscosity improves mixing and handling ease, eliminates the use of diluents in many cases and often lowers the cost of finished compounds.

Complete compatibility with EPI-REZ® 510 and similar resins allows faster and more uniform mixing. Bubbles come out faster and preheating and waiting periods before application are eliminated. Now you can handle compounds at lower temperatures with less sweat-out.

Longer pot-life permits larger batches and more time for application. After application there is more time for bubbles to surface and break resulting in better wetting.

When You Think of Epoxy Resins, Come to the People Who Pioneered in Their Development and Manufacture!

Direct inquiries to Resin and Chemicals Division, Station E, Louisville 8, Ky.

JONES-DABNEY CO. Division of Devoe & Raynolds Co., Inc.

Louisville, Ky. • Newark, N. J. • Los Angeles, Calif.

New Materials

Write item numbers on Readers' Service Card (p. 81) to obtain more information.

PVA Copolymer

Resyn 28-1310, National Starch and Chemical Corp.'s PVA copolymer, can be modified by reaction with organic aminohydroxies to form water and solvent soluble resins for aerosol hair sprays. The copolymer, supplied to packers in a water insoluble, dry pearl is made water soluble by neutralization with AMPD. Weighing 6.6 pounds per gallon, this odorless material has an intrinsic viscosity of 0.3.

Readers' Service Item 1

Vacuum Metallizing Lacquers

Lacquers for application before and after the deposition of aluminum in vacuum metallizing polystyrene have been introduced by Schwartz Chemical Co. BC-107, the base coat, is a heat-cured lacquer intended to prevent craze or lift. The top coat, TC-101, is applied after the deposition of aluminum. It resists abrasion and removal from the metallized surface. Both lacquers may be sprayed, dipped, or flow-coated. Each is first air dried for several minutes before being oven dried at 150° F.

Readers' Service Item 2

Plastics Coating Material

Uni-clad, a one-package coating for fiberglass reinforced polyester and phenolic plastics, has been introduced by Universal Paint & Varnish, Inc. The material is claimed to possess unusual bonding and weathering characteristics and outstanding resistance to flexing, impact, abrasion, moisture, acids, and alkalis.

Uni-Clad may be sprayed or dipped in a one-coat operation or used as the top coating where a primer is required to fill the fiberglass pattern. A baking schedule of 30 minutes at 300°F. is sufficient to set the finish.

Readers' Service Item 3

Synthetic Pearl Pigment

Metal Corp., has announced the introduction of Nacromer Z, a synthetic pearl pigment for incorporation into methacrylate, polyesters, other thermoplastics, and for coating plastics and other materials. Supplied as a paste concentrate, this brilliant material has relatively good opacity, excellent light stability, and heat stability in the range 350-400° F. Two types are made: "A" has a bluish tint by reflected light and a yellowish tint by transmitted light; "B", a faintly yellow tint by reflection and purplish-blue by transmission.

Readers' Service Item 4

Flexible Epoxy Resin System

Houghton Laboratories, Inc.'s Hysol 10-55 is a two-component, epoxy system developed especially for embedding end turns and slot sections of motor stators. Its thixotropicity permits its application by spatula, thus eliminating the need for molds. No drip-off or running is encountered, and its flexibility prevents cracking during temperature changes.

The orange resin may be cured for 16 hours at 215° F., or for four hours at 275° F. It has a shelf life of two months and a pot life, at room temperature, of three or four days. Properties of the system include:

Specific gravity	1.52
Shrinkage, in./in	0.015
Hardness, Shore D.	80
Elongation, %, room temp.	45
Tensile strength, psi., room temp	3,100
Volume resistivity, ohm-cm., room temp.	1.76×10^{14}
220° F	9.27×10^{10}
Dielectric constant, 220° F., 100 cps.	6.23
10 KC.	5.68
Dissipation factor, 220° F., 100 cps.	0.0640
10 Kc.	0.0469

Readers' Service Item 5

Polyester Intermediate

Eastman Chemical Products, Inc., has announced the availability of 1,4-cyclohexanedimethanol for synthesizing saturated polyesters intended as plasticizers and for preparing unsaturated polyesters and polyurethanes. This alicyclic glycol, with two primary hydroxyl groups, is supplied as a 70% solution of the stereoisomeric mixture in methanol. The solvent free material analyzes 97.5% 1,4-cyclohexanedimethanol comprising 32.2% of the cis isomer, and 67.8% of the trans isomer. Typical properties of the methanol solution are:

Refractive index, $n_D^{20°}$	1.4362
Saponification number	2.05
Color (A.P.H.A.), ppm	0
Specific gravity at 25° C	0.9675
Viscosity, 77° F., cs	28.00

Readers' Service Item 6

Glass-Base Epoxy Laminates

Two general-purpose grades of Dilecto epoxy-impregnated, glass base laminates are available from Continental-Diamond Fibre Corp. Designated GB-28EV-2 and GB-16EV-2, the grades are similar except that the latter is made from a finer weave cloth that permits its use in thinner laminates and for closer machining. Both are available in plain sheets 38 inches square or 38 by 42 inches, and as copper-clad sheets for printed circuit applications. GB-16EV-2 is available from 0.010 to ⅛ inch thick, and GB-28EV-2, from 1/32 to 1 inch thick. The latter is also sold as rolled tubing.

Electrical property tests on ⅛-inch thick

NEW 8-PAGE NACREOUS PIGMENT HANDBOOK

Learn about the various grades of natural and synthetic pigments available . . . how to best use them . . . and much other valuable information. Write today for your copy of this valuable guide. Ask for handbook no. 1202.

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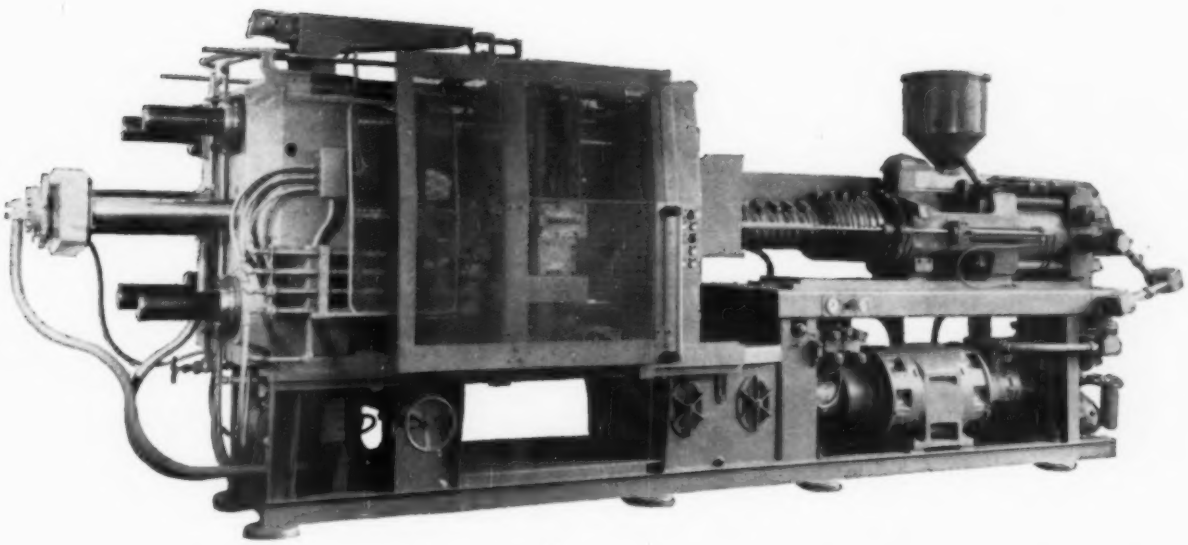
Announcing A NEW "IMPCO"

Injection Molding's Most Versatile Performer!



Impco Model HA16–425

20 ounce injection molding machine

The size of the new HA16-425 "Impco", combined with its speed and adaptability, make it Injection Molding's most versatile performer! Seven hundred and twenty dry cycles per hour at full 24½ inch stroke — two hundred pounds per hour plasticizing capacity — hydraulic knockout — live adjustments, are but a few of the many features contained in this machine. Let us show it to you.

IMPCO®

IMPROVED MACHINERY INC.

NASHUA, NEW HAMPSHIRE

In Canada, Sherbrooke Machineries Limited, Sherbrooke, Quebec

Export Distributors: Omni Products Corp., 460 Fourth Avenue, New York, New York

samples of both grades of Dilecto showed the following results:

Dielectric strength, parallel, stepwise, Kv.	65
Perpendicular, short time, vpm.	600
Loss properties, 60 cycle, dissipation factor	0.012
Dielectric constant	4.71
Loss factor	0.056
Loss properties, 1 mc., dissipation factor	0.020
Dielectric constant	4.75
Loss factor	0.095
Arc resistance, sec.	1.30
Insulation resistance, megohms, *	100.000
Volume resistivity, megohm-cm.,*	2.4 x 10⁷
Surface resistance, megohms, *	200.000

*Tested at conditions of 96 hours at 35° C. and 90% relative humidity.

Readers' Service Item 7

Acrylic Molding Powders

Rohm & Haas Co. has added three new grades to its Implex line of high impact acrylic molding powders. While Implex B, with high gloss; Implex C, with improved stain resistance; and Implex F, featuring heat resistance; are noted for impact strength, none is as resistant as the original Implex developed several years ago.

Following are average physical properties of the new members of the series:

	B	C	F
Specific gravity	1.16	1.18	1.16
Tensile strength, maximum, psi	7300	7600	8000
Modulus, psi	300,000	325,000	325,000
Elongation, %	25	15	25
Flexural strength, maximum, psi	11,500	12,000	12,000
Modulus, psi	360,000	360,000	360,000
Impact Strength, Charpy, ft.lb., 73° F	20	13	20
—13° F	17	9	17
Izod, ft.lb./in. notch, 73° F	0.8	0.5	0.8
—13° F	0.5	0.3	0.5
Compressive strength, maximum, psi	10,500	11,500	12,000
Modulus, psi	325,000	380,000	385,000
Hardness, Rockwell L,	89	93	94
Barcol	69	74	73
Heat distortion temperature, 264 psi, °F	174	174	189
66 psi., ° F	185	185	207
Flammability, in./min.	0.5	0.6	0.7
Mold shrinkage, mil./in.	4-8	4-8	4-8
Flow temperature, ° F	295	285	325
Water absorption, 24 hr. immersion, weight gain, %	0.3	0.3	0.3

Readers' Service Item 8

Fluorocarbon Film

E. I. du Pont de Nemours & Co. has added FEP-fluorocarbon film to its line of Teflon resins. Like the older TFE-fluorocarbons, FEP-fluorocarbon film has outstanding heat and chemical resistance, electrical characteristics, and lubricity. At temperature up to 400° F., it differs from them only in melt-flow properties.

Especially recommended for electrical and electronic applications, FEP-fluorocarbon film is expected to be used in coil-wound devices, capacitors, wire and cable, and rigid and flexible printed wiring. Transparent in thin gages, the film will insulate effectively in very thin sections. Its chemical inertness and lubricity suggest it for use in corrosion resistant pipe and equipment linings and as a mold release.

Typical properties of Teflon FEP-fluorocarbon film are:

Ultimate strength, psi.	3,000
Ultimate elongation, %.	250
Tensile modulus, psi.	43,000
Pneumatic impact, kg./cm./mil	4
MIT flex-cycles	4,000
Graves tear strengths, lbs./in./thickness	600
Coefficient of thermal expansion, in./in./° F. (—100° to 160° F.)	4.61 — 5.85 x 10⁻⁵
Thermal conductivity, BTU/hr./ft.²/°F./in.	1.35
Density, gm./cc.	2.15
Coefficient of friction, inclined plane	0.09
Temperature range, °C., continuous	—85 to 200
Intermittent	—85 to 250
Moisture vapor transmission rate, gm./100m²/hr./mil.	30
Moisture absorption, %	<0.01
Dielectric strength, volts/mil, 1-mil film	3,200
15-mil film	1,500
Dielectric constant	2.2
Dissipation factor	0.0002
Volume resistivity, ohm-cm.	>10¹⁷
Surface Resistivity, ohm.	>10¹³
Surface arc resistance, sec.	>165

FEP-fluorocarbon film is heat-sealable, heat-formable, vacuum-formable, can be metalized and, in some instances, can be bonded to other materials without adhesives.

Readers' Service Item 9

QUALITY CONTROL

Testing Machines for
- RESEARCH
- DEVELOPMENT
- QUALITY CONTROL

ISN'T IT TRUE?

The technical man well knows that the prudent selection of a quality control test helps maintain high product standards and eliminate costly rejections.

- Manufacturers
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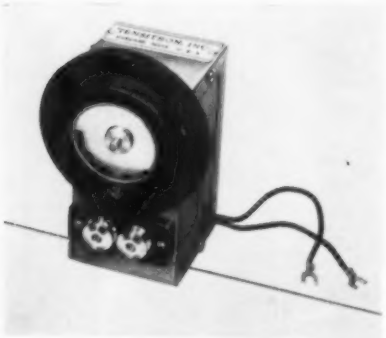
New Equipment

Write item numbers on Readers' Service Card (p. 81) to obtain more information.



Tensitrol control unit.

Electric Tension Control

Tensitron, Inc.'s electric tension control guides filamentous materials around an expendable elastic cover to prevent deformation or abrasion of sensitive materials. Non-slip traction is established between the filament and the elastic pulley with the aid of serrations in the groove of the latter. Because the electrical control box may be operated within any reasonable distance from the tension wheel, the tension control may be used in inaccessible locations. Energy on moving parts may be supplied by sliprings or electric switches which control the motor of a processing unit.

Readers' Service Item 21

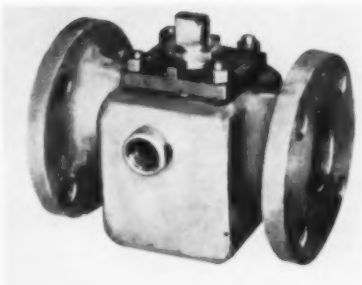
Air-Powered Router Accessories

Buckeye Tools Router.

Buckeye Tools Corp. is manufacturing its #31R-730B air-powered router with an enlarged base and three accessories: a router guide with main section for making cuts at uniform distances and vernier section for accurate final adjustment of the guide; a trammel point used with router guide to cut circles; and a cam sub-base for cutting grooves wider than the bit without resetting the straight edge.

Including accessories, the router is 7 inches long. Capacity is ¼-inch collet. Cutting bit operates as high as 20,000 rpm. Maximum operating efficiency requires 90-100 psi. working pressure through ¼-inch I.D. hose.

Readers' Service Item 22



Continental's Tufline sleeved valve.

Teflon-Sleeved Valves

Continental Manufacturing Co.'s Tufline sleeved valves are suggested for use with heated or cooled media. A Teflon sleeve, fully enclosed by metal, eliminates the need for lubrication and keeps the valve tight without adjustment.

Available in standard 150# and 300# two-way and three-way bottom entry designs, the valves are wrench operated in flanged-end sizes from ½ through three inches, and gear operated in sizes three to six inches. They can be supplied in stainless steel, Alloy 20, carbon steel, aluminum, bronze, Hastelloys, Monel, and nickel. The valves will withstand temperatures as low as —150° F., and pressures from high vacuum to 615 psi.

Readers' Service Item 23

10-Millionths Micrometer

Model PDR Carson-Dice Automatic Electronic Micrometer, available from J.

Model PDR Carson-Dice Automatic Electronic Micrometer.

W. Dice Co., yields direct measurements to the fifth decimal place. The machine works on any kind of material. For conducting parts, a regular tip permits measurements at zero pressure. A preload tip for non-conducting materials provides adjustable hold-down pressures of 1.5, 5, 10, and 20 grams. Work capacity is 3 inches; with standard tip, 2½ inches; with Type J pre-load tip, 2 inches. Throat depth is 3 inches. The 60-pound machine, available with spherical or flat tips, is 15½

MICA FLAKES

For REINFORCING

Flexible inert flakes . . . used for reinforcing . . . electrical and thermal insulation . . . special decorative effects.

U. S. MICA CO., INC.
26 SIXTH STREET
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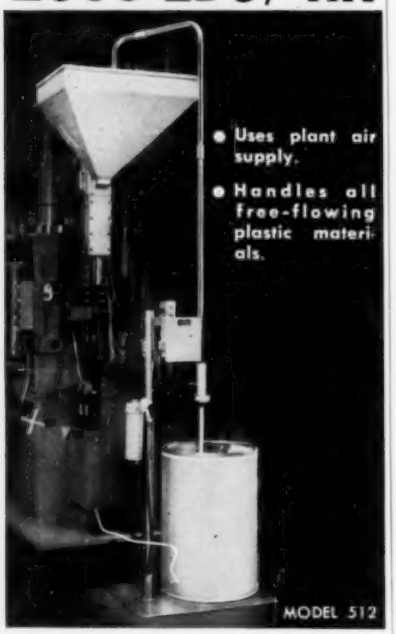
AUTOMATIC AIR CONVEYORS HANDLE UP TO . . .

2500 LBS/HR



- **Self-supporting—no attachment to machine required.**
- **Automatic or manual—full range of sizes.**
- **Ideal for proportioning—transfers directly from shipping containers.**
- **Interdepartmental transfer of materials possible.**

Whitlock screw-type conveyors for dust-free loading.

Whitlock hopper-dryer — dries air to —20 dewpoint.

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☐ Air conveyors ☐ Screw-type conveyors ☐ Hopper-Dryer

Name _____

Title _____

Firm _____

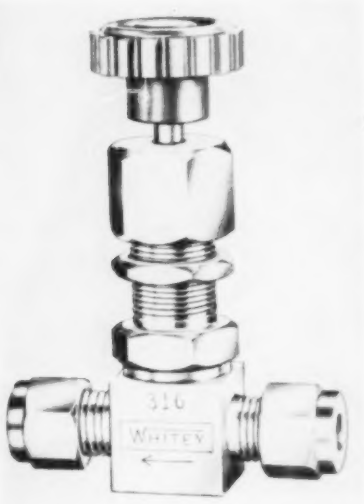
Address _____

inches high, 12 inches deep, and 7½ inches wide.

Readers' Service Item 24

Metal Micro Regulating Valves

Availability of a series of micro-regulating needle and fingertip control valves in sizes from ¼ to ½ inch has been announced by Whitey Research Tool Co. The valves, furnished in stainless steel, Monel, and Hastelloy, have either screwed or union bonnets. The former's working pressure is 2,000-3,000 psi; the latter's, 5,000 psi. The line includes female and male models with angle or straight bodies. Series 120 of tube fitting valves has an orifice diameter 0.093 inch; series 130, orifice diameters 0.093 or 0.156 inch; 140, 0.203; 150, 0.145; 160, 0.145 or 0.250; 160, 0.145 or 0.250; 170 and 180, 0.312; and 190 and 200, 0.375.



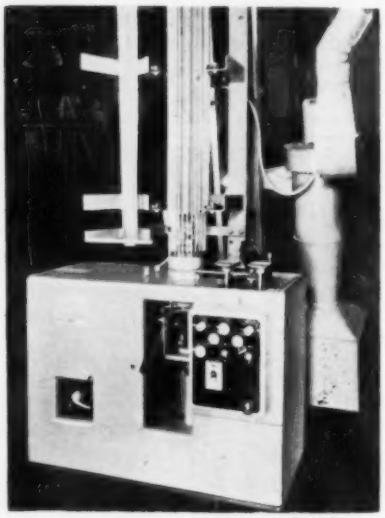
White union bonnet stainless steel valve.

Readers' Service Item 25

Vertical Cut-Off Saw

National Copper & Smelting Co. is manufacturing a cut-off saw which cuts up to 100,000 pieces of 3/16-inch tubing and 25,000 pieces of 1-inch tubing per hour. The saw reportedly has fast set-up time, eliminates extra tooling for size changes, and reduces scrap loss because it can cut from small pieces.

Vertically-fed material up to 20 feet long will be produced in burr-free lengths from ¼ to 7 inches. The machine occupies a 40 by 50 inch floor space. It has an enclosed blade and vacuum-type chip collector; end pieces are automatically dropped out a scrap chute.



National Copper Vertical Cut-Off Saw.

Readers' Service Item 26

Preform Preheating Units

According to Girdler Process Equipment Division of Chemetron Corp., its Thermex high-frequency dielectric heating units for preheating plastics preforms to molding temperatures will increase production efficiency and operating economy. In the line, designated CP, are four units with rated power output ranges up to 15 kw.

Preheat times from 70-250° F. for general purpose phenolic molding compound

Thermex Model CP-10-A.

range from a minimum of seven seconds for a 4-ounce load in model CP-10-A to a maximum of 70 seconds for a 10-pound load in the CP-40-A.

An electronic heating cycle controller automatically adjusts for variations in moisture content, density, and room temperature. A re-set electric timer for maintaining repeated uniform heating times is also standard equipment.

Electrode areas of the Thermex preheaters are 10 by 10 inches for CP-10-A, 10 by 12 for CP-20-A, and 15 by 15 for CP-30-A and CP-40-A. Electrodes are adjustable up to 3¾ inches high in the two smaller models and five inches in the larger.

Readers' Service Item 27

Circuit-Master Automold.

Injection Molding Control

Circuit-Master Automold, an electronic control unit that automatically stops an injection molding machine from applying clamping pressure when dies are not closing properly, has been developed by Wintriss, Inc. According to the manufacturer, it protects molds while reducing downtime and material waste without affecting the time cycle.

The unit operates on overlapping sensing impulses from the die cylinder and the mold. If the die cylinder's hydraulic pressure exceeds a predetermined setting due to misalignment of die parts, tightening of die pins, lack of lubrication, foreign matter lodged in the molds, or other malfunction, Automold stops and reverses the die motion and opens the mold.

The sensing elements are set at the time the mold is installed in the machine, and require no adjustments while the shut height of the mold remains unchanged. Automold compensates for mechanical and heat expansions, and is unaffected by temperature changes.

Readers' Service Item 28

Blow Molding Machines

Johann Fischer blow molding machines, distributed in this country by Barclay Industries, Inc., will accommodate all thermoplastics. Under fully automatic operation, material is successively extruded and blown. Adaptable to a multiplicity of heads, the machines are supplied with custom-sized platens.

Following are maximum dimensions in inches of objects blown on the Fischer operating with single heads.

Model No.	Diameter, hollow object	Height, hollow object	Dimensions, irregular object
BM 500	2.95	7.48	2.96 x 2.95
BM 500S	4.32	9.04	4.32 x 7.86
BM 2000	5.10	11.02	5.10 x 7.86
BM 5000 SP	5.70	14.99	5.70 x 11.02
BM 10.000	9.45	18.50	9.45 x 14.62
BM 60.000	11.81	27.70	11.81 x 15.74

Readers' Service Item 29

When the problem is inorganic pigments and extenders for compounding plastics...

WILLIAMS *invites you to take advantage of its* **80 YEARS EXPERIENCE**

Today Williams offers a complete line of inorganic pigments and extenders for the plastics industry. All have color permanence and chemical stability. Here is a representative list of these products.

Pure Red Iron Oxides** • **Pure Yellow Iron Oxides** • **Pure Black Iron Oxides** • **Pure Brown Iron Oxides** • **Pure Chromium Oxide Greens** • **Pure Hydrated Chromium Oxides** • **Umbers** • **Siennas** • **Lampblack** • **Anhydrous Calcium Sulfate** • **Barytes** • **Calcium Carbonates

Send today for detailed Technical Reports which give you complete description of the chemical and physical properties of each. Address Department 37, C. K. Williams & Co., 640 N. 13th Street, Easton, Pennsylvania.

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Plastics Applications

Write item numbers on Readers' Service Card (p. 81) to obtain more information.

Disposable PVC Blood Bag

The Pliapak blood bag, non-wettable, flexible, and virtually air-free, has been developed by Abbott Laboratories to expedite blood handling procedures. Especially practical for ambulance and disaster use, the self-collapsing bag of plasticized PVC needs no venting, thereby eliminating the need for an air-intake needle while permitting application of external pressure.

The unit also includes two tamperproof outlets with imbedded hoods; a gummed rubber withdrawal site; and a 15-gage, silicone treated, vein needle seated in plastic. Forty inches of plastic tubing allow leeway for suspending and typing knots. Special two-color labels produced from Texopring, a plastic-coated and impregnated paper developed by Kimberly-Clark Corp., are used to insure against migration or bleeding.

Pliapak bags are supplied sterilized in vaporproof laminated kraft foil polyethylene envelopes.

Pliapak disposable blood bag.

Readers' Service Item 41

Plastic Silverware Basket

A rigid silverware basket for Westinghouse dish washers is now molded from Hercules Powder Co.'s Pro-Fax, a heat-, stain-, and corrosion-resistant polypropylene. It is said that the new baskets cost less than the plastisol-covered wire units they replace, besides having increased resistance to wear and damage by dropping. The basket is molded by Cleveland Plastics Co.

Westinghouse silverware basket.

Readers' Service Item 42

Nylon Sleeve Bearing

Nylasint-2G, Halex Corp.'s oil-filled sintered nylon, is being used in sleeve bearings for Starline, Inc.'s sliding door hangers. Formed by cold pressing and oil sintering an extremely fine graphite-filled polyamide powder, the material reportedly retains oil indefinitely.

Nylasint sleeve bearings minimize frictional drag and help to prevent galvanic corrosion and wear at points of contact between mating parts. Unlike wick-lubricated roller bearings, they maintain a thin oil film on matching metal parts.

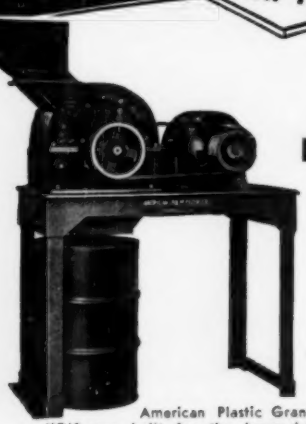
Nylasint-2G bearing.

Readers' Service Item 43

Merry Molded Menagerie

Dr. Seuss Zoo, molded by Revell, Inc., from Grex high-density polyethylene, consists of four fantastic, snap-together, pull-apart animals with interchangeable parts. The four members of the Zoo—Gowdy, the Dowdy Grackle; Roscoe, the Many-Footed Lion; Norval, the Bashful Blinket;

PLASTIC MANUFACTURER REDUCES 200,000 LBS. OF PLASTIC SCRAP YEARLY with this



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ROTARY KNIFE
PLASTIC GRANULATOR

IN USE EVERY DAY . . .
6 DAYS A WEEK!

In the past year, this American KC-9 Rotary Knife Plastic Granulator, installed at a large St. Louis plastic molding company, has regranulated over 200,000 pounds of plastic scrap to a homogeneous granulation . . . at a rate of up to 1500 lbs. per day. (Short scrap is being run through at an average of 300 lbs. per hour.)

American Plastic Granulators—available in two sizes, KC9 and KC12—are built for the heavy-duty demands of constant, tough usage. Size, shape, or kind of plastic is no problem for this sturdy machine. The clean, shearing action of the adjustable rotary cutter blades of fine tool steel, provide fast, once-through regranulation.

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Originators and Manufacturers of Ring Crushers and Pulverizers

Write for your copy of "GRANULATE YOUR PLASTIC SCRAP"

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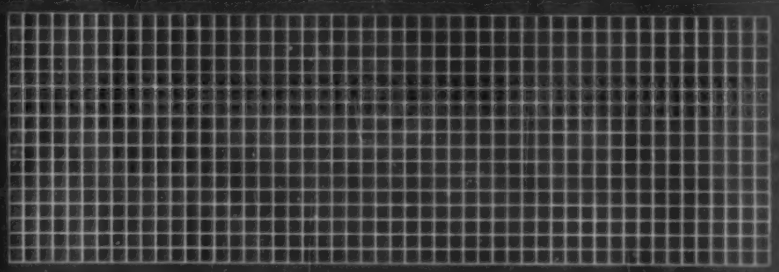
WHAT THEY'RE SAYING ABOUT LUSTREX® PERMA TONE STYRENE

Lighting Fixture Molders: "Easy flow, fast cycles . . ." "No molding job too difficult." "Constant color during molding . . ."



Lighting Fixture Manufacturers: "2 to 3 times more resistant to yellowing . . ." "Exceeds IES–NEMA–SPI specs for light stabilized styrene." "Excellent crystal clarity . . . unlimited color possibilities."

To all the inherent advantages of styrene in lighting—the large areas of illumination, the light weight, good diffusion, unusual design effects—perma tone adds excellent light stability, a resistance to yellowing up to three times better than regular styrenes. Proven in use by leading fixture manufacturers, without formulation changes since 1956, perma tone opens up wide new dimensions in color, including truly translucent whites and other difficult colors.

Lustrex perma tone styrene is available for injection molding or extrusion. Write for complete technical data to Monsanto Chemical Company, Plastics Division, Room 663, Springfield 2, Massachusetts

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No, this is not second childhood, but a symbol of the thoroughness of **RC** performance control. Maybe we can't solve every problem for every molder, but when this doll gets into a little girl's hands, we know she'll be able to take scrubbing and a good deal more affectionate abuse. In every instance our ability to come up with the right properties for your basic products is the result of consistent testing and experience. **RC** Plastisols, Plasticizers, Comonomers, and Insular Vinyl Polymers and Copolymers can be utilized in a vast range of applications. We invite your inquiries for advice, technical bulletins and samples. Whether we have the final answer in stock or we come up with a modified or custom-made formula, the quality and performance of your product will prove . . . **RC** was there!

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Gowdy, the Dowdy Grackle.

and Tingo, the Noodle-Topped Stroodle —can be varied to suit the creator's whims. Parts from different animals can be mated for further variety.

The polyethylene is supplied by W. R. Grace & Co.

Readers' Service Item 44

Polyester Insulation

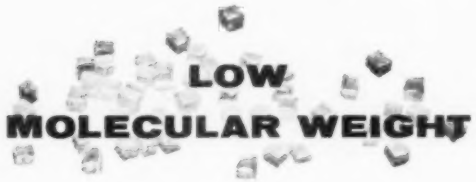
Lenco Inc.'s Hi-Amp models of electrode holders, ranging in size from 100 amperes (11 ounces) to 500 amperes (28 ounces), are insulated with Laminac polyester pre-mix molding compound. Their bright colors, red tips and trigger, and yellow handle, molded of the glass-filled Laminac, offer instant identification and safety.

The polyester pre-mix, a product of American Cyanamid Co., provides high impact strength, flame and heat resistance, good electrical properties, and low moisture absorption.

Lenco Hi-Amp electrode holder.

Readers' Service Item 45

Polyethylene Means Greater Profit!



A-C® Polyethylene

FOR FASTER CYCLES

HOW do you get faster operations?

With A-C Polyethylene, faster operations are a *certainty*. Your equipment can be operated at lower pressures and at increased speeds. Melt index is always under perfect control. No release problems even with mirror-finish molds or other time-consuming difficulties with A-C Polyethylene! It all adds up to a faster, more profitable operation.

HOW can you cut down on grades in inventory?

Don't tie up your money! A few virgin resin grades do the work of a wide selection of melt indices. A switch to A-C Polyethylene gives you, at your command, a "tailor-made" resin to fit a particular end part. A simple change of low molecular weight percentages in the dry blending step will give you a wide control of characteristics. Let us demonstrate with a trial run.

---

for INJECTION MOLDING

Molders who use A-C Polyethylene in their operation gain distinct competitive advantages. Controlled gloss, better color dispersion, and the ability to run larger, more intricate parts and the filling of multi-cavity molds are the definite product advantages. Faster cycle, positive mold release, lower operating temperature and less overall machine maintenance, are the profit-making features contributed by the controlled flow possible with A-C Polyethylene.

for SLUSH MOLDING AND CENTRIFUGAL CASTING

A-C Polyethylene offers an entirely new material for slush molding. With this new polymer you can use less expensive molds; you get faithful mold reproduction with fine detail; and the finished part has a warm, "life-like" feel. Finishes from dull to high gloss are possible. Finished products can be decorated to any specifications.

for FILMS, PLAIN AND COLORED

In the extrusion of polyethylene film, adding A-C Polyethylene can give faster rates at lower extrusion temperatures and make gauge control easier.

For colored film, A-C Polyethylene is invaluable for even, streakless pigment dispersion. Colored films using A-C Polyethylene dispersed color pigments are strikingly brilliant and uniform.

for PLASTIC COATINGS

Coatings containing A-C Polyethylene give a hard, scuff-resistant, glossy surface. Excellent low temperature flexibility and the elimination of blocking problems are added attractions to the converter.

Bread and frozen food wraps are glossy and scuff-resistant.

Shipping cartons are grease resistant and need no liner to protect contents from fibre scratchings.

Butter and frozen food cartons, and bakery cartons are grease resistant and feed as single units to automatic packaging machinery.

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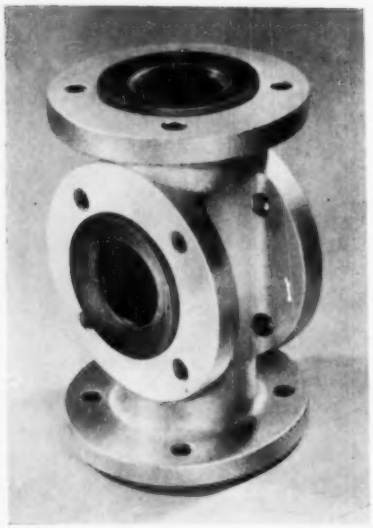

Lined Resistoflex Type-S cross.

Fluorocarbon-Lined S Crosses

Chemically-inert Type-S crosses lined with Fluoroflex-T are available from Resistoflex Corp. This lining is a non-porous compound made from tetrafluoroethylene resin, and it extends over the full gasket face of the four flanges. Thus, a balanced rate of thermal expansion-contraction is maintained between the 150# ductile iron housing and the inner wall. One-six inch Type-S crosses are currently marketed.

Readers' Service Item 46

Polyethylene Toothbrush

A toothbrush designed to be used once and then discarded has been introduced by Flex-I-Brush Corp. Molded in one piece from Celanese Corp.'s Fortiflex linear polyethylene, the disposable toothbrush is marketed already charged with dentifrice in a sealed, sanitary packet. Available in dispenser boxes for volume users such as hotels or commercial airlines, the packaged unit has a shelf life of at least 18 months. The brush was developed by Progressive Engineering & Developing Co.

Flex-I-Brush disposable toothbrush.

Readers' Service Item 47

Optically Clear Laminate

Goodyear Aircraft Corp.'s three-layer laminate, Thermoshield, is reported to have the heat resistance, structural strength, and optical clarity required for supersonic aircraft canopies. To make the laminate, an F-3 resin adhesive is cast between preformed layers of a heat-resistant plastic and a stretched acrylic, after which the assembly is cured at a temperature under 220° F. The interlayer, F-3, is flexible and heat resistant, cures at relatively low temperature, casts easily, and sticks to glass, polyesters, and acrylics.

GAC Thermoshield.

Readers' Service Item 48

Polyethylene Tackle Boxes

For the first time in its 143-year history, B. F. Gladding & Co., Inc., has introduced a line of plastic tackle boxes made from W. R. Grace & Co.'s Grex high-density polyethylene. Sixteen boxes are available in five series, each of different dimensions, number, and arrangement of compartmented trays. The trays have a cantilever action, and all boxes are fitted with solid brass links, pins, and rivets. Packaging is in transparent polyethylene.

Features of Grex which make it a desirable material for tackle boxes include its unbreakability, resistance to temperatures from —65 to 250° F., solvent and grease resistance, floatability, and resistance to both salt and fresh water. Colors are resistant to sunlight.

Gladding's line of high-density polyethylene tackle boxes.

Readers' Service Item 49

Decorative Plastic Laminate

With the assistance of Reynolds Metals, Swedlow, Inc., has developed and put on the market a deglossed decorative laminate that requires no brushing to achieve a low-reflective, satin finish. The laminate, Kevinite, consists of impregnated core papers with an overlay of thermosetting resin and a matte-finish, surface film of polyvinyl alcohol.

Kevinite is sold in rolls and sheets 30 and 36 inches wide in several woodgrain patterns.

Kevinite 227 furniture finish.

Readers' Service Item 50

New Literature

Write item numbers on Readers' Service Card (p. 81) to obtain more information.

"The Last Word in Coal-Tar Derivatives." Plastics and Coal Chemicals Div., Allied Chemical Corp. 4 pages. Nomenclature and descriptions of plasticizers, phthalic anhydride, anthracene, acetophenone, ethylbenzene, aromatic solvents, tar acids and oils, tar bases, phthalonitrile, and other materials is supplied. The folder does not provide detailed characteristics.

Readers' Service Item 61

"Tolylene Diisocyanate." Chemical Safety Data Sheet SD-73. Manufacturing Chemists' Association, Inc. 15 pages. This pamphlet provides properties and information for safe handling of this pungent liquid. Topics covered are engineering control of hazards, employee safety, storage, equipment cleaning and repairs, waste disposal, and first aid.

Readers' Service Item 62

"Wall Chart of Conversion Factors." Precision Equipment Co. 1 page. This yellow-and-black reference table is organized in four columns of three parts each: multiply-by-to obtain.

Readers' Service Item 63

"Rubbatex." Rubba, Inc. 1 page. A polyethylene packaging adhesive is described.

Readers' Service Item 64

"Improved Casting Techniques for Void-Free Encapsulation of Electrical Components." Technical Bulletin 101. Automatic Process Control, Inc. 6 pages. Beginning with problems encountered in evacuation systems or caused by improper mold design or poorly selected resin systems, this paper proceeds to discuss three basic approaches to void-free casting: post de-gassing, pre de-gassing and vacuum casting, and pressure stalling.

Readers' Service Item 65

"Chemical-Loaded Molecular Sieves." Linde Co. 36 pages (4 bulletins). Two booklets present general information about molecular sieves, synthetic, crystalline alumino-silicate materials used for absorbing curing system accelerators. The other two describe type 4A activated powder—sodium alumino silicate, and CW-2015, ditertiary butyl peroxide adsorbed on molecular sieve type 13X. Applications are suggested.

Readers' Service Item 66

"Marlex." Phillips Chemical Co. 42 pages. One part of this bulletin illustrates and describes uses for different types of Marlex. Data sheets feature tables and figures of properties, processing and pigmenting information, and applications.

Readers' Service Item 67

"How to Measure for IMS Replacement Heating Cylinders." Injection Molders Supply Co. 44 pages. By means of diagrams, this booklet outlines information which must be known when ordering replacement cylinders. Blank fill-ins for each brand machine are included to simplify ordering.

Readers' Service Item 68

"Cycolac." Marbon Chemical Div., Borg-Warner Corp. 8 pages. ABS resins may be used for molded parts, extrusions, and formable sheet. Mechanical, electrical, thermal, and impact strength properties of Cycolac types T, H, L, and C are given.

Readers' Service Item 69

"Drycol Dry Colorants for All Thermoplastics." Gering Products, Inc., 4 pages. This booklet includes a standard color key chart for polyethylene and polystyrene, information on special colors and special effects, and color nomenclature. It also outlines other services and products, such as master batches for polyethylene, polypropylene, vinyls, and polystyrene, and color concentrates for polyethylene.

Readers' Service Item 70

"Teflon Skived Sintered Tape." Product Data Sheet 1. Chemo Products, Inc. 4 pages. Applications, properties, and specifications of this white skived tape are listed.

Readers' Service Item 71

"This is Propypropylene." Avisun Corp. 4 pages. Physical properties of polypropylene which may be used for injection molding, extrusion, film, or fiber, are tabulated.

Readers' Service Item 72

"PVP." TA-52. Antara Chemicals, Dyestuff & Chemical Div., General Aniline & Film Corp. 8 pages. This pamphlet describes the effectiveness of polyvinylpyrrolidone in reducing the toxicity and sensitivity problems inherent in phenols and other compounds by forming molecular adducts with them.

Readers' Service Item 73

"Check-List for Plastics Buyers." Commercial Plastics & Supply Corp. 4 pages. This guide to the use of plastics in production, maintenance, and safety includes a listing of the uses and safety characteristics of common thermoset and thermoplastic materials.

Readers' Service Item 74

"Metalflake." "A Dash of Brilliance." Dobeckmun Co. 6 pages each. Metalflake, tiny bits of precision-cut, colored metallic foil, is made from aluminum laminated with Mylar polyester film or acetate, or from coated aluminum foil. A sample sheet of this decorative material is included in the descriptive literature.

Readers' Service Item 75

"How to Work with Plexiglas." Cadillac Plastic & Chemical Co. 20 pages. This booklet gives detailed information on machining (layout, cutting, sawing, punching, drilling, routing, shaping, and turning); forming (jig and clamp, plug and ring, drape, blow, and vacuum); and finishing (hand and machine sanding, filing, scraping, and buffing) Plexiglas sheets and other acrylic shapes.

Readers' Service Item 76

"Marvinol General Purpose Vinyl Resins." Naugatuck Chemical Div., U. S. Rubber Co. 5 pages. Five technical data sheets provide descriptions of uses and properties of VR-22, 23, 24, 25, and 26.

Readers' Service Item 77

"TC-459 Epoxy Resin." Electronic Production & Development, Inc., 5 pages. Catalog sheets and suggested processing techniques illustrate and describe this epoxy resin for the sealing and reinforcing of electrical connectors, wiring, cable, and other equipment against corrosion, insulation failure, and moisture contamination. Electrical and physical properties are included.

Readers' Service Item 78

"Capstan Grips." Bulletin 119-TT. Thwing-Albert Instrument Co. 2 pages. The operation, application, and advantages of capstan grips as a means of holding flexible sheet materials for tensile strength testing are considered. The grips, illustrated and diagrammed, use the force exerted on the sample during the test for clamping pressure.

Readers' Service Item 79

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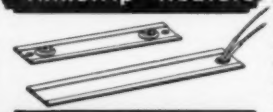

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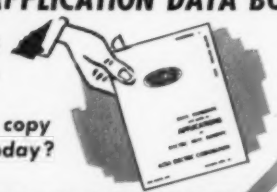

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Book Reviews

"Physical Chemistry of High Polymers." Maurice L. Huggins. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Cloth, 6 by 9 inches, 175 pages. Price, $6.50.

This advanced text is concerned with applying the theory of physical chemistry to polymers. The author describes in detail the molecular structures of synthetic and natural high polymers and, on this basis, explains their properties. Among recent developments covered is the author's previously unpublished theory of the dependence of thermodynamic properties of polymer solutions on the sizes, shapes, and structures of the component molecules. Other properties with which he is concerned are viscosity, plastic flow, and elasticity.

The author not only discusses structure, composition, and configuration of high polymers in general, but also covers some typical addition and condensation polymers. Separate discussions are devoted to the structures of cellulose and starch, collagen, and synthetic and corpuscular proteins.

"Finishing and Decorating." Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y. Paper, 5 by 7 inches, 35 pages. Price, $.75.

The third in a series of inplant training booklets deals with methods and equipment for finishing and decorating molded plastic parts. Emphasis is placed on points common to all finishing and decorating departments, such as salvage of the maximum number of off-standard pieces, cleanliness, maintenance of all standards of quality, and good housekeeping.

"Cost Manual for Piping and Mechanical Construction." Herbert Herkimer. Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10, N. Y. Cloth, 6½ by 9½ inches, 176 pages. Price, $10.00.

This book of 115 tables, calculated in man-hours, is intended to help estimators save time and effort in arriving at reliable figures and to enable plant maintenance managers and engineers to pre-estimate roughly how much a job should cost and to check submitted estimates. Divided into two main categories, piping and mechanical construction, the plastic-bound reference opens flat for easy use.

"American Drafting Standards Manual: Section 11—Plastics." ASA Y14.11-1958. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Paper, 8½ by 11 inches, 22 pages. Price, $1.50.

This bulletin recommends basic preferred design and drafting practices for plastic parts. A brief discussion of materials and manufacturing processes has been included as an introduction to design and drawing hints for molded and laminated plastic parts. Over-all product design, tolerances, and methods of dimensioning are not discussed.

The figures illustrate principles described in the text, but are not fully dimensioned engineering drawings.

"Physical Properties of Polymers." S.C.I. Monograph No. 5. Macmillan Co., 60 Fifth Ave., New York 77, N. Y. Cloth, 5½ by 8½ inches, 293 pages. Price, $6.00.

This volume comprises the following papers read at the Silver Jubilee Symposium held at the University of London, April 15-17, 1958, by the Plastics and Polymers Group: Crystallinity in Polymers: Occurrence, Measurement, and Influence on Properties; Optical Properties of Strained Amorphous Polymers; Permeability of Plastics and Rubbers to Water and Water Vapour, as Measured by the Hygrophotographic Method; Structure and Properties of Polypropylene; Mechanical Properties of Sheet-Forming Thermoplastics at Fabrication Temperatures; The Effect of Injection Moulding Conditions and Flow Orientation of Properties; The Measurement of the Mechanical Properties of Plastics at Very Low Temperatures; Breakdown of Polymeric Insulation by Gaseous Discharges; Electrical Tracking Testing; Conduction and Polarization Processes in Plasticized Polyvinyl Chloride Compounds; The Impact Strength of Tough Plastics; Variation of Physical Properties of Melamine Moulding Materials with Curing Time; Applications of Rebound Resilience to the Cure of Polyester Resins; Some Applications of Dynamic Elastic Measurements in Polymer Systems; Non-Linear Viscoelastic Effects in Ethylene Polymers; The Relation Between Coefficient of Friction and Dynamic Properties of Polyvinyl Chloride; Dynamic Mechanical Behaviour of Partially Crystalline Polymers; The Influence of Strain upon the Dynamic Properties of Natural Rubber; The Mechanical and Dielectric Temperature/Frequency Equivalance of Polymers: GR-S.

Most papers are preceded by an abstract.

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Patent Digest

Materials

High Molecular Weight Vinylaromatic Hydrocarbon Maleic Anhydride Copolymers and Process for their Preparation. No. 2,872,436. B. B. Hibbard, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

A copolymer of maleic anhydride and a styrene (average molecular weight at least 700,000) is made by mixing the reactants with methylene chloride in the presence of a catalytic amount of an organic peroxide.

Antistatic Resin Compositions. No. 2,872,432. A. P. Metzger, Tampa, Fla. (to Union Carbide Corp.).

A polymer of a monovinylidene compound which has a tendency to accumulate electrostatic charges.

Stabilization of Polymeric N-Vinyl Pyrrolidones with Sulfurous Acid or Alkali Metal Salts Thereof. No. 2,872,433. S. A. Glickman, Easton, Pa. (to General Aniline & Film Corp., New York, N.Y.).

Solid polymeric N-vinyl pyrrolidone is stabilized against discoloration with a solution in sulfurous acid or an alkali metal salt of sulfurous acid.

Vinyl Aromatic Polymers Stabilized with Dimethylalkylene Diamines. No. 2,873,264. W. K. Schweitzer, Jr., Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Fiber-Forming Composition Comprising Cellulose Acetate and Acrylonitrile Copolymer and Fiber Consisting Essentially of Same. No. 2,872,424. N. W. Abernathy, Midland, E. M. Diss, Sanford, and T. W. Sarge, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

An acrylonitrile copolymer of vinyl chloride or vinylidene chloride is dissolved with cellulose acetate in a mutual solvent.

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Equipment

Apparatus for Forming Plastic Closures on Receptacles, No. 2,874,413. J. Grussen, Paris, France.

Apparatus for Injection Moulding of Plastic Material. No. 2,872,705. M. Labarre, Paris, France (to Specialties Alimentaires Bourguignonnes (S. A. B.), Dijon, France).

Extrusion Apparatus. No. 2,872,703. R. D. Gambrill, Idlewylde, and A. N. Gray, Edgewood, Md. (to Western Electric Co., Inc., New York, N. Y.).

Apparatus for Injection Molding of Plastic Bottles. No. 2,872,700. E. R. Knowles, Fairfield, Conn. (to Specialty Papers Co., Dayton, O.).

Applications

Microviscometer. No. 2,865,197. C. J. Penther and R. L. Griffin, Oakland, T. K. Miles, Orinda, and W. C. Simpson, Berkeley, Calif. (to Shell Development Co., New York, N. Y.).

Viscosities of small amounts of plastic material may be determined by means of two opposing smooth-surface plates. After a small amount of material is inserted between the plates, the degree of movement of one plate, as measured by a flag, indicates the viscosity of the material.

Method of Laminating Vinyl Chloride to Metal with Synthetic Resin-Rubber Adhesive and Resultant Article. No. 2,872,366. C. E. Kiernan, Naugatuck, and W. K. Clark, Woodbury, Conn. (to U.S. Rubber Co., New York, N.Y.).

A laminate comprises an exterior film of vinyl chloride resin and electrolytic zinc-coated steel base joined by an adhesive of rubbery and resinous terpolymers.

Coated Thermoplastic Material and Method of Coating Thermoplastic Material. No. 2,872,347. M. Goland, New York, L. Goland, Malverne, and I. M. Bernstein, Brooklyn, N.Y. (to Printon Corp., New York, N.Y.).

A base material based on polymers or copolymers of vinylidene chloride is coated with a film of a vinylidene chloride-acrylonitrile copolymer.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.
—The Editor

Abstracts of Important Articles

Materials

"Fundamentals of the Mechanical Properties of Plastics," B. Bossu, M. Chatain, P. Dubois, and J. Rougereaux, *Ind. Plastiques Mod.*, 11, 3, 36; 11, 4, 43 (March & April, 1959).

This paper was read at the International Symposium on Testing and Standardization of Plastics, ISO/TC 61, held in October 1958 in the United States. The authors first present experimental and theoretical data on the mechanical properties of plastics moldings, then consider the choice of tests and of samples, and finally deal with the testing methods themselves, stressing the usefulness of type objects. (In French.)

"New Reinforced TFE Plastics Resist Cold Flow," N. L. Greenman, *Materials Design Eng.*, 50, 4, 98 (Oct. 1959).

A discussion of the compositions and properties of five types of TFE resins.

"Injection Molding: A Rheological Interpretation—Part 2," R. L. Ballman, Lewis Shusman, and H. L. Toor, *Modern Plastics*, 37, 2, 115 (Oct. 1959).

The conclusion of a two-part article that analyzes test results in terms of the theory presented in the initial installment of the paper.

"An Easy Way to Control Cure of Polyester Resins," J. M. Smith and R. B. Bennett, *SPE J.*, 15, 10, 867 (Oct. 1959).

A graphic method for controlling cure is presented.

"Epoxidized Polyolefin Resins," F. P. Greenspan, Chris Johnston, and Murray Reich, *Modern Plastics*, 37, 2, 142 (Oct. 1959).

The chemistry and properties of these resins are discussed.

"Ethylene-Butene Copolymer Resins," J. E. Pritchard, R. M. McGlamery, and P. J. Boeke, *Modern Plastics*, 37, 2, 132 (Oct. 1959).

The chemistry, properties, and suggested applications are presented for these new resins.

"Interfacial Properties of Polyesters at Glass and Water Surfaces," R. R. Stromberg, W. M. Lee, and A. R. Quasius, *SPE J.*, 15, 10, 883 (Oct. 1959).

Data on how configuration of an absorbed polymer molecule affects interfacial properties.

Equipment

"The Elastic Melt Extruder Works Without Screws," Bryce Maxwell and A. J. Scalora, *Modern Plastics*, 37, 2, 107 (Oct. 1959).

Comparative test data are given for this unit and a conventional screw-type extruder.

"Check Points for Buying Machinery to Fit Your Plans," G. B. Thayer and R. E. Monica, *Western Plastics*, 6, 10, 37 (Oct. 1959).

Check points when buying injection, extrusion, and compression molding machines.

"Reinforced Plastics Molding Equipment," G. R. Mallory, *Western Plastics*, 6, 10, 40 (Oct. 1959).

Check list of points to consider when buying presses and auxiliary equipment.

Applications

"Plastic Glazing for High-Speed Aircraft," Carey Carpenter, *Modern Plastics*, 37, 2, 129 (Oct. 1959).

Available materials and suggested designs for composite structures.

"Reinforced Low Density Moldings," R. F. Newberg and D. L. Graham, *Plastics World*, 17, 10, 26 (Oct. 1959).

How sandwich structures are made of l-d plastics.

"Plastic Radomes at Elevated Temperatures—Theory and Practice," F. H. Behrens and C. W. Gwinn, *SPE J.*, 15, 10, 881 (Oct. 1959).

A view of the future and its materials for radome use.

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in February. The last listing appeared in the October issue.

Directory

1 time	$19.00 per inch
6 times	$18.00 per inch
12 times	$15.00 per inch

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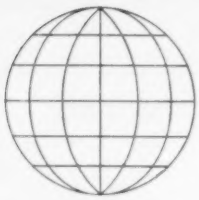

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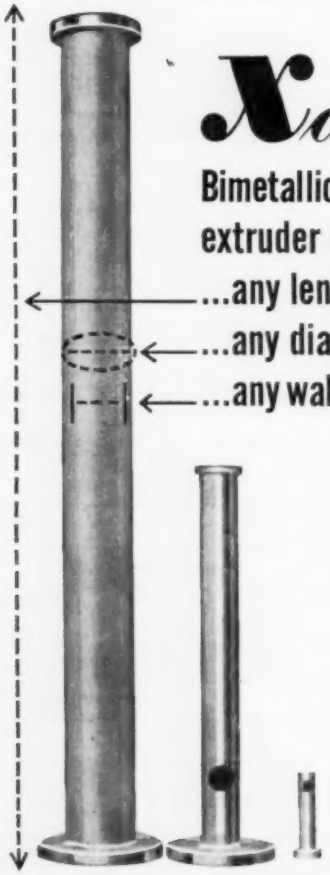

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Adhesives

Crystal Essence Dekophane	gl.	$4.75	

Colors

Crystal Essence Dekopearl	lb.	.70 /	9.75
Cyanamid Inorganic pigments			
Chrome greens	lb.	.42 /	.45
Molybdate chrome oranges	lb.	.48 /	.49
Organic pigments			
Accosperse Cyan blue	lb.	.84 /	1.34
Cyan green	lb.	1.38 /	.169
Hansa yellow G	lb.	.93 /	1.22
Naphthol Red Y	lb.	1.20 /	1.36
Toluidine Red XL	lb.	.81 /	.91
United cobalt blue	lb.	.26 /	.35
Ultramarine blue	lb.	.17 /	.325
Ultramarine green	lb.	.245 /	.265
Ultramarine red	lb.	.45 /	.47
Ultramarine violet	lb.	.29 /	.31

Plasticizers

Celanese Celluflex 21	lb.	.3925 /	.4275
23	lb.	.3475 /	.3875
112, 179A, 179C, 179EG, Lindol	lb.	.325 /	.37
CEF	lb.	.49 /	.54
DBP	lb.	.26 /	.30
DOP	lb.	.29 /	.29
TPP	lb.	.415 /	.435
Eastman NP-10	lb.	.4[illegible] /	.48

Resins and Molding Compounds

Polyethylene

Spencer Polyeth 2504	lb.	.365 /	.515
2905	lb.	.375 /	.525
2812	lb.	.39 /	.54
3405	lb.	.34 /	.49
3812	lb.	.43 /	.58
All others	lb.	.315 /	.465

Vinyls

Vygen PVC	lb.	.235 /	.41

Stabilizers

Vanstay A	lb.	.50 /	.53
AB	lb.	.46 /	.49
AC	lb.	.45 /	.48
CE	lb.	.44 /	.47
HT	lb.	.87 /	.90
HTA	lb.	.97 /	1.00
HTB	lb.	.70 /	.73
HTC	lb.	1.09 /	1.12
HTE	lb.	.80 /	.83
L	lb.	.32 /	.35
R	lb.	.67 /	.70
RR	lb.	.59 /	.62
RZ-25	lb.	.65 /	.69
S	lb.	.57 /	.60
SA	lb.	.81 /	.84
W	lb.	1.22 /	1.25
Z	lb.	.62 /	.65

CALENDAR of COMING EVENTS

January 26-27
Society of Vacuum Coaters. Biltmore Hotel, New York, N. Y.

January 27
Symposium on High Speed Testing. Somerset Hotel, Boston, Mass.

February 1
American Society of Heating, Refrigeration, and Air-Conditioning Engineers.

SPI Symposium on Plastics in Domestic Refrigeration: Improving Performance and Customer Acceptance of Plastics in Domestic Refrigeration Appliances. Baker Hotel, Dallas, Tex.

February 2-4
SPI Reinforced Plastics Division Conference. Edgewater Beach Hotel, Chicago, Ill.

March 30-31
Plastics Institute. Conference on Polymeric Progress. William Beveridge Hall, London University, London, England.

April 5-7
Building Research Institute Spring Conferences: Plastics Information Workshop. Statler-Hilton Hotel, New York, N. Y.

April 20
SPE North Texas Section RETEC. Plastics in the Petroleum and Chemical Industries. Hotel Texas, Fort Worth, Tex.

May 20-31
Norsk Plastforening. International Plastics Exhibition. Oslo, Norway.

Domestic Production and Sales of Plastics and Resin Material, August and September, 1959

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of August and September, 1959. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

	August, 1959		September, 1959	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,545,631	1,528,429	1,545,809	1,498,096
Sheets, 0.003 gage and over	1,840,966	1,635,993	1,829,111	1,798,222
All other sheets, rods, and tubes (including other cellulose plastics)	699,672	841,539	811,692	866,919
Molding and extrusion materials (including other cellulose plastics)	8,689,694	8,457,468	8,876,780	8,788,841
Nitrocellulose sheets, rods, and tubes	238,145	126,931	246,769	184,700
TOTAL	13,014,108	12,590,360	12,310,161	13,116,777
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	18,236,957	17,288,848	20,247,773	18,242,820
Bonding and adhesive resins for—				
Laminating (except plywood)	6,694,128	4,731,749	7,151,065	5,075,319
Coated and bonded abrasives	1,314,641	1,137,811	1,436,373	1,342,443
Friction materials (brake linings, clutch facings, and similar materials)	1,737,303	1,406,117	1,451,630	1,393,838
Thermal insulation (fiber glass, rock wool)	4,533,188	4,244,425	4,370,782	4,620,433
Plywood	5,225,138	4,540,335	5,959,444	4,846,906
All other bonding and adhesive uses	4,988,753	4,829,250	5,289,883	5,309,431
Protective-coating resins unmodified and modified except by rosin	2,427,203	1,987,149	2,271,694	1,690,688
Resins for all other uses	3,792,222	3,501,137	4,081,231	3,897,202
TOTAL	48,949,533	43,666,821	52,279,875	46,419,080
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,915,913	2,400,850	2,687,613	2,425,608
Paper-treating and paper-coating resins	2,566,070	2,411,842	2,571,655	2,274,032
Bonding and adhesive resins for—				
Laminating	2,980,112	2,395,596	3,494,265	2,611,288
Plywood	7,729,464	9,308,607	9,002,997	9,797,844
All other bonding and adhesive uses	1,775,619	1,644,813	1,780,746	1,875,477
Protective-coating resins straight and modified	3,168,173	2,286,718	3,713,943	2,737,888
Resins for all other uses, including molding	10,400,484	10,245,977	11,513,536	10,446,441
TOTAL	31,535,835	30,694,403	34,764,755	32,168,578
Styrene Resins:				
Molding and extrusion materials:				
Straight polystyrene	20,879,639	21,038,657	23,973,549	22,782,258
All other	30,481,615	25,456,533	34,217,064	28,908,149
Protective coatings	5,597,488	4,849,271	6,860,122	6,313,492
Textile and paper treating and coating resins	5,112,461	3,925,000	5,444,208	4,219,125
All other uses	12,736,104	14,108,414	12,194,101	15,496,167
TOTAL	74,807,307	69,377,875	82,689,044	77,719,191
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		7,073,586		7,112,128
Sheeting (resin content)		10,750,191		11,274,858
Molding and extrusion (resin content)		25,069,040		28,105,736
Textile and paper treating and coating (resin content)[3]		5,683,053		6,386,877
Flooring (resin content)		12,867,271		11,938,540
Protective coating (resin content)		2,601,946		2,904,356
All other uses (resin content)		7,940,358		7,844,301
All other vinyl resins for—				
Adhesives (resin content)		4,915,042		5,166,864
Protective coatings (resin content)		2,402,014		2,075,119
All other uses (resin content)		9,977,471		9,464,512
TOTAL	98,765,712	89,279,972	98,924,036	92,073,291
Coumarone-Indene and Petroleum Polymer Resins	23,798,208	24,058,312	23,062,745	24,114,973
Polyester Resins:				
For reinforced plastics	10,022,499	8,261,221	9,300,784	8,483,025
For all other uses	1,371,329	1,426,776	1,752,509	1,692,826
TOTAL	11,395,828	9,687,996	11,053,293	10,175,851
Polyethylene Resins:				
For film and sheeting		27,758,326		29,617,149
Molding materials		18,880,335		18,761,354
Extrusion materials		13,309,109		12,987,017
For all other uses		31,352,593		41,499,604
TOTAL	103,097,099	91,300,363	104,615,636	102,865,124
Epoxy Resins:				
For protective coatings		1,748,316		1,829,832
For all other uses		2,167,753		1,871,540
TOTAL	5,063,024	3,916,069	4,970,453	3,701,372
Miscellaneous Synthetic Plastics and Resin Materials, Including Silicone Resins	20,684,551	16,532,793	22,779,507	18,200,366
GRAND TOTALS	431,109,205	391,104,964	448,449,505	420,554,603

[1] Includes fillers, plasticizers, and extenders.
[2] Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3] Includes data for spreader and calendering-type resins.
SOURCE: United States Tariff Commission, Chemical Division.

INDEX TO ADVERTISERS*

JANUARY 1960

Acra Electric Corporation 74
Agency: A. W. Sayre Company

American Alkyd Industries 13
Agency: Hayden Advertising, Incorporated

American Pulverizer Company 68
Agency: Batz-Hodgson-Neuwoehner Advertising Agency

Argus Chemical Corporation 6
Agency: Geer DuBois & Company, Incorporated

Bee Chemical Company 28
Agency: Symonds, MacKenzie & Company, Incorporated

Cadet Chemical Corporation 75
Agency: Herbert Margrill, Advertising

Catalin Corporation of America 1
Agency: Walter J. Gallagher, Advertising

Celanese Corporation of America
Plastics Division 17
Agency: Ellington & Company, Incorporated

Columbian Carbon Company 26
Agency: Donahue & Coe, Incorporated

Detroit Mold Engineering Company 30
Agency: LaRue-Cleveland, Incorporated

Devoe & Raynolds Company, Incorporated
Jones-Dabney Company Division 61
Agency: Erwin Wasey, Ruthrauff & Ryan, Incorporated

Emery Industries, Incorporated 18
Agency: Farson, Huff & Northlich, Incorporated

Erie Engine & Manufacturing Company 14
Agency: The Yount Company

B. F. Goodrich Chemical Company ..... 3rd cover
Agency: The Griswold-Eshleman Company

The Harshaw Chemical Company ..... 4th cover

Hercules Powder Company
Naval Stores 29
Agency: Fuller & Smith & Ross, Incorporated

Hooker Chemical Corporation
Durez Plastics Division 27
Agency: The Rumrill Company, Incorporated

Improved Machinery 63
Agency: Hillsborough Advertisers

Industrial Research Laboratories 78
Agency: Boylhart, Lovett & Dean

Injection Molders Supply 23
Agency: Industrial Merchandizing Specialists

H. Kohnstamm & Company, Incorporated 74
Agency: The Zlowe Company, Advertising

[illegible]ter-Phoenix, Incorporated 64
Agency: PDA Advertising Agency

Log[illegible] Hydraulics, Incorporated 76
[illegible]gency: Raymond C. Hudson & Associates, Incorporated

Mearl Corporation 62
Agency: Richard-Lewis Advertising

Mobay Chemical Products Company 10-11
Agency: Ketchum, Macleod & Grove, Incorporated

Modern Plastic Machinery Corporation 24
Agency: Ted Gravenson

Monsanto Chemical Company
Organic Division 25
Agency: Gardner Advertising Agency

Plastics Division 69
Agency: Needham, Louis & Brorby, Incorporated

National Lead Company 31
Agency: Marschalk and Pratt, Division of McCann-Erickson

Chas. Pfizer & Company, Incorporated
Industrial Division 15
Agency: MacManus, John & Adams, Incorporated

Plastics Engineering Company 5
Agency: Kuttner & Kuttner, Incorporated

The Quaker Oats Company 9
Agency: Headen, Horrell & Wentsel, Incorporated

Reichhold Chemicals, Incorporated 3
Agency: MacMannus, John & Adams, Incorporated

Rubber Corporation Of America 70
Agency: Ovesey and Straus, Incorporated

Semet-Solvay
Petrochemical Division Allied Chemical Corporation 71
Agency: Benton & Bowles, Incorporated

Shell Chemical Company
Plastics & Resins Division ..... 2nd cover
Agency: J. Walter Thompson Company

Sterling Extruders Corporation 16

Testing Machine, Incorporated 64
Agency: Vizza Advertising

U. S. Industrial Chemicals Company
Polyethylene Division 7-8
Agency: G. M. Basford Company

U. S. Mica Company 65
Agency: Terrill Belknap Marsh Associates

Union Carbide Plastics Corporation 20-21
Agency: J. M. Mathes, Incorporated

Welding Engineers, Incorporated 32
Agency: John Miller Advertising Agency

Whitlock Associates, Incorporated 66
Agency: LaRue-Cleveland, Incorporated

C. K. Williams & Company 67
Agency: William A. Hatch, Incorporated

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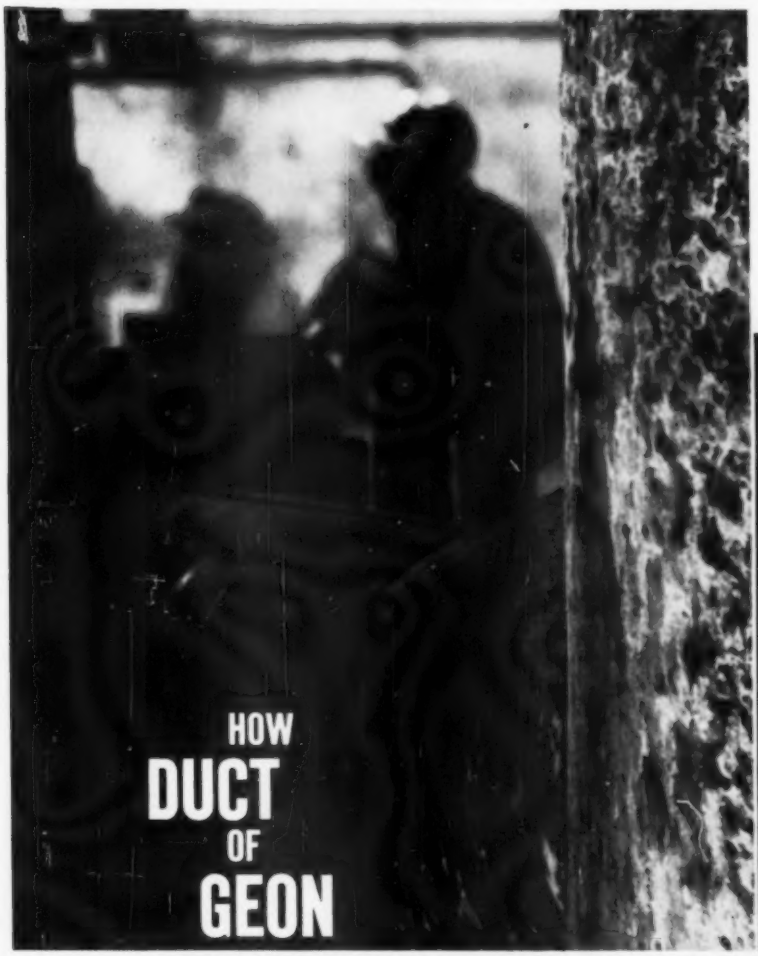

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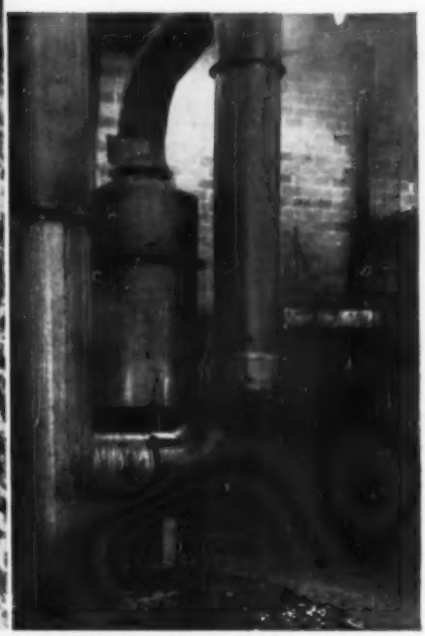

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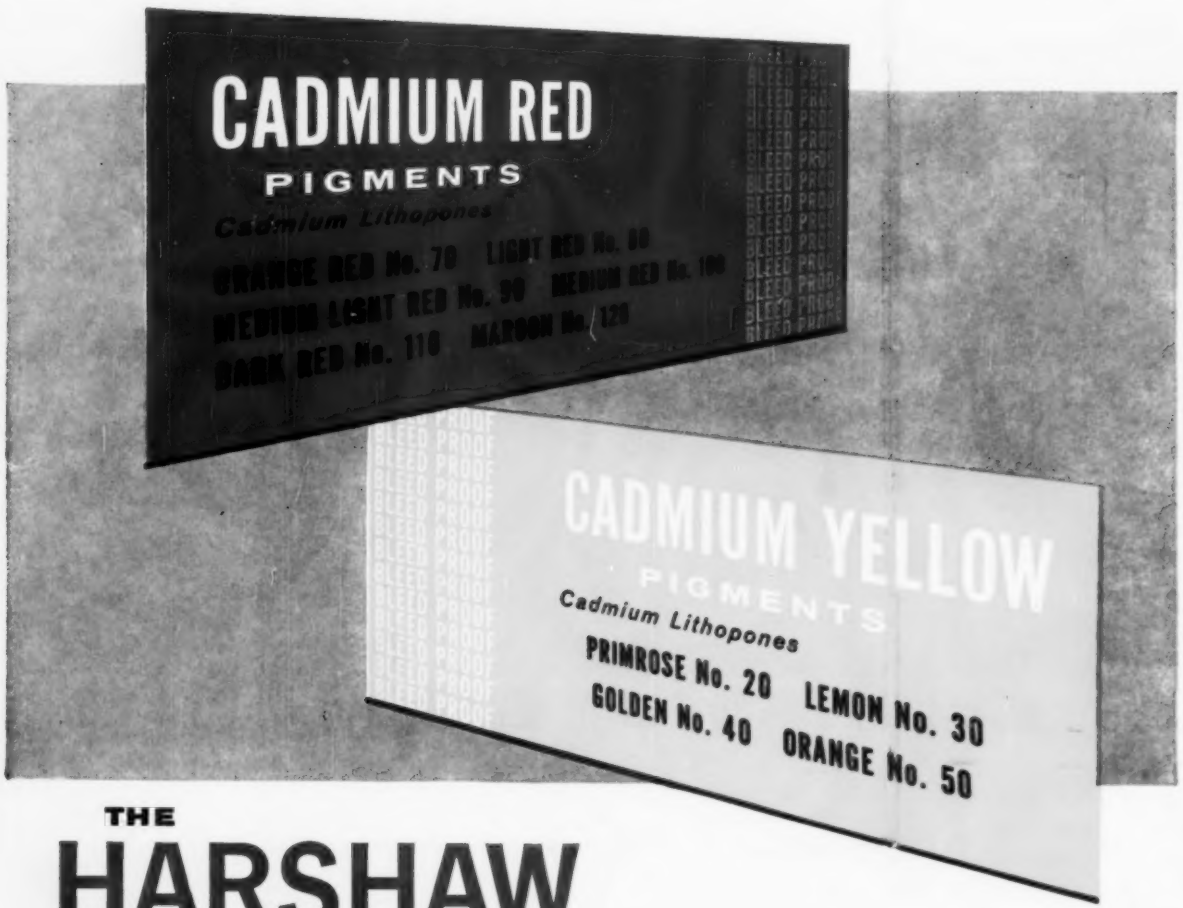

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